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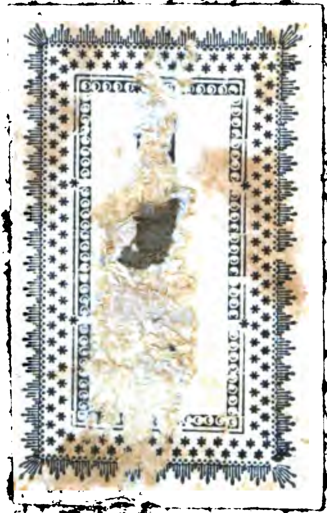

PRACTICAL
AND
MENTAL ARITHMETIC,

DESIGNED PRINCIPALLY TO ACCOMPANY
DABOLL'S SYSTEM OF ARITHMETIC,
(And equally adapted to any other)
CONTAINING IN A CATECHETICAL METHOD,

ALL HIS RULES;

WHICH ARE REQUISITE TO THE SOLUTION OF ANY
SUMS, ORDINARILY OCCURRING IN ACTUAL
BUSINESS, SIMPLIFIED, WITH
CORRESPONDING

EXAMPLES.

TO BE ANSWERED BY A
MENTAL PROCESS,
WITHOUT THE AID OF SLATE OR PAPER.

BY ROSWELL C. SMITH,
Associate Principal of North Main-street Academy.

PROVIDENCE.
Printed at the Microcosm Office.
1826.

KC 11322

RHODE-ISLAND DISTRICT, ss.—Be it remembered that on this thirtieth day of September, in the year of our Lord one thousand eight hundred and twenty-six, and in the fifty-first year of the Independence of the United States of America, Roswell C. Smith, of said District, deposited in this office the title of a book, the right whereof he claims, as author and proprietor, in the following words, to wit: "Practical and Mental Arithmetic, designed principally to accompany Daboll's system of Arithmetic, (and equally adapted to any other,) containing in a catechetical method all his rules, which are requisite to the solution of any sums ordinarily occurring in actual business, simplified with corresponding examples, to be answered by a mental process, without the aid of slate or paper, by Roswell C. Smith, associate principal, of North Main-street Academy."

In conformity to an act of the Congress of the United States, entitled "an act for the encouragement of learning, by securing the copies of maps, charts and books to the authors and proprietors of such copies, during the time therein mentioned," and also, to an act, entitled "an act supplementary to an act entitled an act for the encouragement of learning, by securing the copies of maps, charts, and books to the authors and proprietors of such copies during the time therein mentioned, and extending the benefits thereof to the arts of designing, engraving and etching historical and other prints."

BENJAMIN COWELL,
Clerk of the Rhode-Island District.

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RECOMMENDATIONS.

◆

PROVIDENCE, October, 1826.

THE undersigned have examined Mr. Roswell C. Smith's new *Practical and Mental Arithmetic*, designed to accompany Daboll's Arithmetic, and are satisfied that it is a plan admirably adapted to facilitate youth in their acquisition of this important branch of education; and believing that its dissemination will be of great and permanent utility to the rising generation, they cheerfully recommend it to the use of instructors and to the public patronage.

A. WOODS, *Prof. of Mathematics and Natural Philosophy.*

G. A. DEWITT, *One of the Principals of Providence High School.*

OLIVER ANGELL, *Preceptor.*

ISAAC HARTSHORN, *Preceptor.*

MOSES NOYES, *Teacher of a School for young Ladies*

W. R. DANFORTH.

DYAR T. HINCKLEY, *Principal of Charles Field's street Academy.*

CHARLES HENRY ALDEN, *Preceptor at Olney Place.*

GRAVENER TAFT.

JOSEPH L. SHAW, *Westminster Academy.*

LUTHER AINSWORTH, *Teacher of Youth.*

ORIGEN BACHELER, *Preceptor of New Market Monitorial School.*

ALFRED RICKARD, *Associate Principal of N. Main-Street Academy.*

PREFACE.

THE design of this work is to furnish in a concise, and intelligible form, a complete system of Practical Arithmetic, by questions and answers, both on the rules of operation, and the reasons of those rules: so that the juvenile learner may proceed by a mental, rather than a mechanical process; and be interested and profited by a study, in which he has usually been perplexed and disgusted.

The substance of the work was used in manuscript in my school, till the frequent transcribing became burdensome; and while preparing it for the press, for my own use, several additions and improvements occurred, which it was thought would render it a work beneficial to the rising generation at large.

Among the many systems of Arithmetic in use, I have found none, by means of which the reasons of the various operations, the pupil is subjected to; is rendered sufficiently plain to him. Several recent publications display much ingenuity, but as a whole, contain too much of the merely curious, and too little of the useful. Some are not sufficiently conversant in the things to which Arithmetic is practically applied; and the pupil is even sent into Reduction, perhaps without the aid of the Tables of Weights, Coins, &c. where he makes much the same figure that the mariner would at sea, without his chart. A lack of rudimental examples, has likewise been a notorious defect; very closely allied to the last mentioned. Some authors, who have noticed this defect in the preface to their works, seem scarcely to have thought of it afterwards. Some treatises contain questions on the Rules, with no answers annexed; and in order to find them, the pupil is despatched on a tour of discoveries in regions,

"Where forests of no meaning spread the page
"In which all comprehension wanders, lost, bewildered;"

and if among many laboured sentences, the phraseology of which is precisely as intelligible to him as the Hebrew, he happens to hit the lucky spot, of paper and ink, 'tis well; A throw with dice might have done the same. He treasures up the mysterious prize, and is repaid with silly praise. Another pupil, who when challenged for his answer, should have the sense and spirit frankly to confess, "I can't find it, Sir," would be censured for an idler, or a dunce. The practice indeed of compelling scholars to learn by rote a tedious string of rules, which they are not made to understand the meaning and use of, is altogether preposterous; and would probably have been exploded long ago, but for the magisterial airs of knowing committees and still more knowing parents. If the time, wasted in this employment, were even spent in attempting to acquire the idioms of some foreign tongue, however hopeless the task, it might perhaps excite curiosity respecting other nations and thus prove of some little use.

Arithmetic has been sometimes accounted above the capacity of boys under 10 or 12 years of age; and the profound and intricate science of language, the first principles of which are but with intense application, apprehended by the adult philosopher, have been sagely substituted as the more simple and pleasant exercise of infantile intellect. Arithmetic as usually taught it is confessed, is sufficiently intricate as the preceding observations imply.— At worst however it is obviously better comprehended by children than English Grammar. And taught as it might be, it is thought to be better adapted to their age than any other study. Children necessarily begin the actual use of Arithmetic at an early period, in their sports and interchange of toys about the streets, and by a proper process, it is easy to make them see that the Arithmetic of books and schools is precisely of the same kind, as that which they use every day in buying apples and exchanging marbles.

The grand object is to convey instruction in language which they understand. Their knowledge of things is always greater than their knowledge of words, the signs of things. And of all studies of which they are capable, Arithmetic is best suited to exercise and expand their reasoning faculties. Such are the views with which this little volume is offered to the public.

The examples given for illustration and exercise, have been borrowed from such things and occurrences as are familiar to children, the first being rendered as simple as possible, and gradually increasing in difficulty, to the last.

Federal Money is the coin which has been principally used, as it is generally adopted by men of business throughout the Union.

A new and concise rule is given for computing Simple Interest, which is thought to deserve particular attention

The directions for stating Questions in the Rule of Three, are likewise different from any I have found in other books, and are thought to be an improvement.

Notes designed for instructors are interspersed throughout the book which will claim their careful perusal.

Fractions being simple in their nature and easily understood, are found among the ground rules, and are subsequently introduced sufficiently to answer all purposes of practical utility.

To avoid the embarrassment of abstruse and verbose expressions on the one hand and too much brevity on the other, has been unremittingly studied throughout the volume.

In regard to motive I shall say little. High professions of disinterestedness in an author's preface, seldom obtain implicit credence; and that for the best possible reason, they seldom deserve it. I should be pleased with a compensation for my labour, and hope that the public will find in the utility of the work, an equivalent for the expense i costs them.

ROSWELL C. SMITH.

Providence, October, 1826.

PRACTICAL
AND
MENTAL ARITHMETIC.

Repeat the Addition and Subtraction Table.

2 and 1 are	3
2	4
3	5
4	6
5	7
6	8
7	9
8	10
9	11
10	12
11	13
12	14

3 and 1 are	4
2	5
3	6
4	7
5	8
6	9
7	10
8	11
9	12
10	13
3 and 11 are	14
12	15

4 and 1 are	5
2	6
3	7
4	8
5	9
6	10
7	11
8	12
9	13
10	14
11	15
12	16

5 and 1 are	6
2	7
3	8
4	9
5	10
6	11
7	12
5 and 8 are	13
9	14
10	15
11	16
12	17

6 and 1 are	7
2	8
3	9
4	10
5	11
6	12
7	13
8	14
9	15
10	16
11	17
12	18

7 and 1 are	8
2	9
3	10
4	11

7 and 5 are 12
6 13
7 14
8 15
9 16
10 17
11 18
12 19

8 and 1 are 9
2 10
3 11
4 12
5 13
6 14
7 15
8 16
9 17
10 18
11 19
12 20

9 and 1 are 10
2 11
3 12

9 and 4 are 13
5 14
6 15
7 16
8 17
9 18
10 19
11 20
12 21

10 and 1 are 11
2 12
3 13
4 14
5 15
6 16
7 17
8 18
9 19
10 20
11 21
12 22

11 and 1 are 12
2 13

11 and 3 are 14
4 15
5 16
6 17
7 18
8 19
9 20
10 21
11 22
12 23

12 and 1 are 13
2 14
3 15
4 16
5 17
6 18
7 19
8 20
9 21
10 22
11 23
12 24

Repeat the Multiplication Table, forward, backward, and by Division.

2 times 1 are 2
2 4
3 6
4 8
5 10

2 times 6 are 12
7 14
8 16
9 18
10 20

2 times 11 are 22
12 24

3 times 1 are 3
2 6

3 times 3 are 9
4 12
5 15
6 18
7 21
8 24
9 27
10 30
11 33
12 36

4 times 1 are 4
2 8
3 12
4 16
5 20
6 24
7 28
8 32
9 36
10 40
11 44
12 48

5 times 1 are 5
2 10
3 15
4 20
5 25
6 30
7 35
8 40
9 45
10 50
11 55
5times 12are 60

6 times 1 are 6
2 12
3 18
4 24
5 30
6 36
7 42
8 48
9 54
10 60
11 66
12 72

7 times 1 are 7
2 14
3 21
4 28
5 35
6 42
7 49
8 56
9 63
10 70
11 77
12 84

8 times 1 are 8
2 16
3 24
4 32
5 40
6 48
7 56
8 times 8are 64
9 72
10 80
11 88
12 96

9 times 1 are 9
2 18
3 27
4 36
5 45
6 54
7 63
8 72
9 81
10 90
11 99
12 108

10 times1 are10
2 20
3 30
4 40
5 50
6 60
7 70
8 80
9 90
10 100
11 110
12 120

11 times1are 11
2 22
3 33

11 times4	are44	11tim.12	a 132	12times7	are 84
5	55			8	96
6	66	12 times1	are12	9	108
7	77	2	24	10	120
8	88	3	36	11	132
9	99	4	48	12	144
10	110	5	60		
11	121	6	72		

Repeat the Pence Table.

d.	*s.*	*d.*	*d.*	*s.*	*d.*	*d.*	*s.*	*d.*	*d.*	*s.*	*d.*
20 is	1	8	50 is	4	2	80 is	6	8	110 is	9	2
30	2	6	60	5	0	90	7	6	120	10	0
40	3	4	70	5	10	100	8	4			

Repeat the Table of Pence, Shillings and Cents.

farthings,	*pence,*	*cents,*	*shil.*	*pence,*	*pence,*	*cents.*
1 is	0	⅓			10 is	14
2	0	⅔			11	15
3	0	1	1	0 is	12or	16⅔
4	1 or	1⅓	1	1	13	18
			1	2	14	19½
	2 is	2⅔	1	3	15	21
	3	4	1	4	16	22
	4	5⅓	1	5	17	23½
	4½	6¼	1	6	18	25
	5	7	1	7	19	26½
	6	8⅓	1	8	20	27½
	7	10	1	9	21	29
	8	11	1	10	22	30½
	9	12½	1	11	23	31½

s.	*d.*		*d.*	*c.*	*s.*	*d.*	*d.*	*c.*
2	0		24	33⅓	4	0	48	66⅔
					4	3	51	71
2	3	is	27	37½	4	6	54	75
2	6		30	42	4	9	57	79
2	9		33	46	5	0	60	83
3	0		36	50	5	3	63	87½
3	3		39	54	5	6	66	92
3	6		42	58⅓	5	9	69	96
3	9		45	62½	6	0	72	100

How many cents are 2s. 5d. ?
How many cents are 3s. 1d ?
How many cents are 5s. 2d. ?
How many cents are 6s. 1d. ?
How many cents are 4s. 7d. ?
How many cents are 6s. 9d. ?
How many cents are 9s. ?
How many cents are 7s, 6d. ?
How many cents are 10s. 6d. ?
How many cents are 12s. ?
How many cents are 12s. 6d. ?
How many cents are 12s. 9d. ?
How many cents are 13s. 6d. ?
How many cents are 15s. ?
How many cents are 17s. 6d. ?
How many cents are 18s. ?

ARITHMETICAL TABLES.

Repeat the denominations of Sterling Money.

4 farthings make	1 penny, marked	*d.*
12 pence,	1 shilling,	*s.*
20 shillings,	1 pound,	*£.*

Repeat the denominations of Federal Money.

10 mills make	1 cent, marked	*c.*
10 cents,	1 dime,	*d.*
10 dimes,	1 dollar,	$.
10 dollars,	1 eagle,	*E.*

Repeat Troy Weight.

24 grains (*gr.*)make	1 penny-weight, marked	*pwt.*
20 penny-weights,	1 ounce,	*oz.*
12 ounces,	1 pound,	*lb.*

Repeat Avoirdupois Weight.

16 drams (*dr.*), make	1 ounce,	*oz.*
16 ounces,	1 pound,	*lb.*
28 pounds,	1 quarter of a hundred weight,	*qr.*
4 quarters,	1 hundred weight,	*cwt.*
20 hundred weight,	1 ton,	*T.*

Repeat Apothecaries Weight.

20 grains (*gr.*) make	1 scruple,	℈
3 scruples,	1 dram,	ʒ
8 drams,	1 ounce,	℥
12 ounces,	1 pound,	℔

Repeat Cloth Measure.

4 nails (*na.*) make	1 quarter of a yard,	*qr.*
4 quarters,	1 yard,	*yd.*
3 quarters,	1 Ell Flemish,	*E. Fl.*
5 quarters,	1 Ell English,	*E. E.*
6 quarters,	1 Ell French,	*E. Fr.*

Repeat Dry Measure.

2 pints (*pt.*) make	1 quart,	*qt.*
8 quarts,	1 peck,	*pk.*
4 pecks,	1 bushe	*bu.*

Repeat Wine Measure.

4 gills (*gi.*) make	1 pint,	*pt.*
2 pints,	1 quart,	*qt.*
4 quarts,	1 gallon,	*gal.*
31½ gallons,	1 barrel,	*bl.*
42 gallons,	1 tierce,	*tier.*
63 gallons,	1 hogshead,	*hhd.*
2 hogsheads,	1 pipe,	*p.*
2 pipes,	1 tun,	*T.*

Repeat Long Measure.

3 barley corns (*b.c.*) make	1 inch, marked	*in.*
12 inches,	1 foot,	*ft.*
3 feet,	1 yard,	*yd.*
5½ yards,	1 rod, pole, or perch,	*rd.*
40 rods,	1 furlong,	*fur.*
8 furlongs.	1 mile,	*m.*
3 miles,	1 league,	*lea.*
69½ statute miles,	1 degree, on the earth	
360 degrees, the circumference of the earth.		

Repeat Land, or Square Measure.

144 square inches make	1 square foot.
9 square feet,	1 square yard.
30¼ square yards, or 272¼ square feet,	1 square rod.
40 square rods,	1 square rood.
4 square roods,	1 square acre.
640 square acres,	1 square mile.

Repeat Solid or Cubic Measure,

1728 solid inches make	1 solid foot.
40 feet of round timber, or 50 feet of hewn timber,	1 ton or load.
128 solid feet, or 8 feet long, 4 wide, and 4 high,	1 cord of wood.

Repeat Time.

60	seconds (*S.*) make	1 minute, marked	*M.*
60	minutes,	1 hour,	*h.*
24	hours,	1 day,	*d.*
7	days,	1 week,	*w.*
4	weeks,	1 month,	*mo.*
13	months, 1 day and 6 hours,	1 Julian year,	*yr.*

Repeat Circular Motion.

60	seconds (*s.*) make	1 minute,	
60	minutes,	1 degree,	
30	degrees,	1 sign,	*S.*
12	signs, or 360 degrees,	the whole great circle of the Zodiac.	

General Remark.—The instructor will perceive, that the answers in most cases are much shorter than the questions, and frequently embrace but one word; the design of which is to prevent the pupil from loading his mind with long and abstruse sentences (of the nature and import of which he is utterly ignorant) without giving himself the trouble to think; whereas the mode that is here adopted, it is believed, is calculated to remedy this, by bringing into vigorous exercise the intellectual powers, and thus inducing a habit of thinking, by giving him a clearness of comprehension, and thereby inspiring him with a manly confidence in the correctness of his answers. On this plan much discrimination is to be practised (the want of which is a very great fault in the recital of rules) and this is easily gained, as in many instances, the answers are simply inferences deduced logically from preceding propositions, and in all cases, a little reflection, on the nature of the question, and study, will enable him to give his answers, readily, and understandingly.

In the review, the order of the questions and answers, may be reversed advantageously to the scholar.

What is the use of Troy Weight?—*Ans.* To weigh gold and silver.

What is the use of Avoirdupois Weight?—*Ans.* To weigh hay, flour, &c.

What is the use of Apothecaries Weight?—*Ans.* By it apothecaries compound their medicines.

What is the use of Cloth Measure? *Ans.* To measure cloth.

What is the use of Dry Measure? *Ans.* To measure corn, beans, rye, &c.

What is the use of Wine Measure? *Ans.* To measure liquids.

What is the use of Long Measure? *Ans.* To measure length only.

What is the use of Land, or Square Measure? *Ans.* To measure land, or length and breadth only.

What is the use of Solid, or Cubic Measure *Ans.* To measure length, breadth and depth.

What is the number of days in each month *Ans.* Thirty days hath September,
Also April, June, November;
February hath twenty-eight,
And thirty-one the others rate.

How many has February in Bissextile or leap year? *Ans.* Twenty-nine.

When a year can be divided by 4 without a remainder; what year is it? *Ans.* Bissextile.

How many inches make a hand? *Ans.* 4.

How many feet a fathom? *Ans.* 6.

How are distances measured? *Ans.* By a chain.

How many rods long? *Ans.* 4.

How many links does it contain? *Ans.* 100.

How many feet a geometrical pace? *Ans.* 5.

How many geometrical miles a degree? *Ans.*60.

How many points a line? *Ans.* 6.

How many lines an inch? *Ans.* 12.

How many pounds in a barrel of pork? *Ans.* 220.

How many pounds in a barrel of beef? *Ans.*220.

How many single things make a dozen? *Ans.*12.

How many a dozen a gross? *Ans.* 12.

How many dozen a great gross? *Ans.* 144.

How many single things make a score? *Ans.*20.

How many score make a hundred? *Ans.* 5.

How many sheets of paper make a quire?—*A.*24.

How many quires a ream? *Ans.* 20.

How many parts is an ounce of gold divided into? *Ans.* 24.

What are the parts called? *Ans.* Carats.

How many parts an ounce of silver? *Ans.* 20.

What called? *Ans.* Pennyweights.

How many carats fine is such gold, as will abide the fire without loss accounted? *Ans.* 24.

How many ounces in a pound of silver that loses nothing in trial? *Ans.* 12.

What is that baser metal which is sometimes mixed with silveror gold, called? *Ans.* Alloy.

How many characters are there in Arithmetic to express numbers? *Ans.* 10.

How many of these are called figures? *Ans.* 9.

What are they? *Ans.* 1, 2, 3, 4, 5, 6, 7, 8, 9.

What is the other character called? *Ans.* 0, or cypher.

By what other name are they sometimes called? *Ans.* Digits.

How many Roman letters are used to express numbers? *Ans.* 7.

What are they? I,V,X,L,C,D,M.

What do two parallel horizontal lines signify?

Ans. Equality; as 5 and 9 are equal to=14.

What does St. George's Cross signify?

Ans. Addition; as 8 and 7 are equal to 15; thus 8+7=15

What does one horizontal line signify?

Ans. Subtraction; as 3 taken from 9 leaves 6; thus 9—3=6

What does St. Andrew's Cross signify?

Ans. Multiplication; as 8 multiplied by 3 makes 24; thus 8×3=24.

What does a horizontal line between two points signify?

Ans. Division; as the number of times 5 there are in 20; thus 20÷5=4.

What do 8 dots signify.

Ans. Proportion; as 2 is to four, so is 8 to 16 thus 2 : 4 : : 8 : 16.

ARITHMETIC.

What is the computing by numbers called? *Ans.* Arithmetic.

How many rules for its operation? *Ans.* Five.

What are they?—*Ans.* Notation, or Numeration, Addition, Subtraction, Multiplication and Division.

How many values have figures? *Ans.* Two.

What are they? *Ans.* Simple and Local.

What is the value of a figure standing alone? *Ans.* Simple, What is its value when combined with other figures? *Ans.* Local; as 20.

What is the value of a cypher standing alone? *Ans.* No value.

Does it increase or diminish the value when placed at the right hand of figures? *Ans.* Increase.

In what proportion? *Ans.* Tenfold.

What is the art of numbering called? *Ans.* Notation, or Numeration.

Which hand begin to numerate? *Ans.* Right.

Which hand to read? *Ans.* Left.

In reading what value do you give those figures that were called units, when numerated? *Ans.* Units.

What value do you give hundreds? *A.* Hundreds.

What thousands &c.? *Ans.* Thousands and so on.

Repeat the Numeration Table, and the corresponding value of the figures prefixed, without looking on the book.

Quatrillions.	53
C. of Thousands of Trillions.	53
X. of Thousands of Trillions.	53
Thousands of Trillions.	53
C. Trillions.	53
X. of Trillions.	53
Trillions.	53
C. of Thousands of Billions.	53
X. of Thousands of Billions.	53
Thousands of Billions.	53
C. of Billions.	53
X. of Billions.	53
Billions.	53
C. of Thousands of Millions.	53
X. of Thousands of Millions.	53
Thousands of Millions.	53
C. of Millions.	53
X. of Millions.	53
Millions.	53
C. of Thousands.	53
X. of Thousands.	53
Thousands.	53
Hundreds.	53
Tens.	53
Units.	53

Repeat the Notation by Roman Letters.

I	1	XV	15		
II	2	XVI	16	CC	200
III	3	XVII	17	CCC	300
IV	4	XVIII	18	CCCC	400
V	5	XIX	19	D	500
VI	6	XX	20	DC	600
VII	7	XXX	30	DCC	700
VIII	8	XL	40	DCCC	800
IX	19	L	50	DCCCC	900
X	10	LX	60	M	1000
XI	11	LXX	70	MD	1500
XII	12	LXXX	80	MDC	1600
XIII	13	XC	90	MDCC	1700
XIV	14	C	100	MDCCCXXVI.	1826

ADDITION.

What is the collecting of numbers together in one sum called? *Ans.* Addition.

What is the collecting of several numbers of the same kind, or denomination called? *Ans.* Simple Addition.

What do you mean by the same kind, or denomination? *Ans.* All pounds, all dollars, all cents. or all drams, &c.

How place units tens, &c. *Ans.* units under units, tens under tens, &c.

What hand begin to add? *Ans.* Right.

How do you carry? *Ans.* One for every ten, or set down the right hand figure, and carry the left hand figure or figures to the next column.

What do you mean by carrying so may as you have tens? *Ans.* Add so many to the next column.

What is the proof? *Ans.* Cut off the upper line, and find the amount of the rest; then if this amount and upper line when added, be equal to the first amount, the work is right.

Why begin to add to the right hand? *Ans.* Because figures increase from the right to the left.

Why carry one for every ten *Ans.* Because ten units makes one ten, and ten tens one hundred and so on.

To illustrate:—You have 4 marbles in one hand, and six in the other, how many have you in both hands?

How many are four and six then?

By what name are 4 and 6 added together called? *Ans.* Amount.

EXAMPLES.

You bought an orange for nine cents, and a mellon for 15 cents; what did you pay for both?

James bought a top for 6 cents, a knife for 12 cents, and an inkstand for 8 cents; how much did they all come to?

Harry, and James lose some money, James lost 20 cents, and Harry 12; how much did they both lose?

A boy laid out ten cents in marbles, 8 cents in quills, 6 cents for a slate pencil; how much did he lay out in all?

You give 20 cents for Practical Arithmetic, 8 cents for a ruler, 9 cents for an inkstand, and lose 6 cents;—how much money has gone from you?

A man gave his children money in the following manner; to his oldest 3 dollars, to James 5 dollars, to Thomas 9 dollars and to his two daughters 4 dollars apiece; how much did he give away?

A boy bought 20 marbles for 20 cents, 6 peaches for 8 cents and 3 apples for 2 cents;—how much money did he lay out?

A man bought a cart for 6 dollars, a plough for 2 dollars, and a pair of steers for 9 dollars, and 2 acres of land for 8 dollars; how much did he lay out in all?

How old would you be, were your age double what it now is?

If you had three times as many fingers, and thumbs as you have now, how many would you have in all?

How many quarters to an apple, or any thing? *Ans.* Four.

How many thirds to an apple, or any thing? *Ans.* Three.

If an apple, a number, or any thing is divided into 4 equal parts; what would one of these parts be called?

In the above, if divided into 3 equal parts; what would one part be called?

If an apple or any thing, is divided into 5 equal parts what would one part be called? *Ans.* One fifth, or $\frac{1}{5}$.

What would 2 parts be called? *Ans.* Two fifths or $\frac{2}{5}$.

What would 4 parts be called? *Ans.* Four fifths, or $\frac{4}{5}$.

How many parts take to make 5 fifths? *Ans.* 5.

How many parts take to make the whole? *Ans.* 5.

Why is $\frac{5}{5}$ the whole? *Ans.* Because the whole of the apple, was divided into five equal parts.

If $\frac{1}{4}$ of an apple cost 2 cents, what will a whole apple cost?

If $\frac{1}{6}$ of an apple cost 1 dollar, what will the whole cost?

If you give 6 eagles, for one third of a vessel, for how many eagles can you buy the whole vessel?

What is the sum of the following numbers?

1 2
1 2 3
1 2 3 4
1 2 3 4 5
1 2 3 4 5 6
1 2 3 4 5 6 7
1 2 3 4 5 6 7 8
1 2 3 4 5 6 7 8 9
1 2 3 4 5 6 7 8 9 10
1 2 3 4 5 6 7 8 9 10 11
1 2 3 4 5 6 7 8 9 10 11 12

Note—The above is to be added from left to right; as 1 and 2 are 3; 1 and 2 are 3 and 3 are 6; beginning on the left of the top line, afterwards, from right to left; then perpendicularly, without looking in the book during the recital of it in either way by keeping the order of the figures in the mind, and studied so much, as to be added fluently.

2 2 2 2 2 2 2 2 2 2 2 2
3 3 3 3 3 3 3 3 3 3 3 3
4 4 4 4 4 4 4 4 4 4 4 4
5 5 5 5 5 5 5 5 5 5 5 5
6 6 6 6 6 6 6 6 6 6 6 6
7 7 7 7 7 7 7 7 7 7 7 7
8 8 8 8 8 8 8 8 8 8 8 8
9 9 9 9 9 9 9 9 9 9 9 9
10 10 10 10 10 10 10 10 10 10 10 10
11 11 11 11 11 11 11 11 11 11 11 11
12 12 12 12 12 12 12 12 12 12 12 12

Note.—The foregoing is to be recited in the following manner:—Add in the top line the two first figures, touching a finger for each figure, till the two first figures in each line are added; then go over with these two figures again, and taking one more figure in the top line; and in adding, touch one finger more, or three fingers in all, and so on till through with these three in every line, continuing to increase one figure, and one finger, till all the fingers, and thumbs are taken on both hands; as 2 and 2 are 4; touching 2 fingers; when the two first columns are finished, say 2 and 2 are 4 and 2 are 6; touching three fingers or a finger for each figure 2, and so on.

It will be found to be both a pleasing, and profitable exercise for the student, and give him a facility in adding, which he will not acquire so effectually in any other way, except in posting accounts, the nature of which it greatly partakes.

⁂ The learner is not to look on the book during the recital.

SUBTRACTION.

What is the process of taking one number from a larger, and thereby shewing the difference between the two numbers called? *Ans.* Subtraction.

What is the process of taking one number from another of the same kind, or denomination called? *Ans.* Simple Subtraction.

What do you mean by the same kind, or denomination? *Ans.* All dollars, all guineas, all mills, or all seconds. &c.

To explain this rule, take in the hand ten marbles, take out six, how many are left?

Six from ten, leaves how many then?

How many parts in Subtraction? *Ans.* Three.

What are they? *Ans.* Minuend, Subtrahend, and Difference,

What is the largest number called? *A.* Minuend.

What is the smaller? *Ans.* Subtrahend.

What is that which is left after subtracting? *Ans.* Remainder.

In the illustration by marbles above, which is the minuend?

Which is the subtrahend?

Which is the remainder?

Which two parts do you add together, to prove subtraction? *Ans.* Subtrahend and Difference.

What must the amount be like? *Ans.* Minuend.

In the above example, which two numbers do you add together in the proof?

How do you know the sum is right? *Ans.* Because 4 and 6 are 10, as many as I had in my hand in the first place.

How place units to subtract? *Ans.* Under units.

How place tens, hundreds, &c. *Ans.* Tens under tens, hundreds under hundreds, &c.

Which hand begin to subtract at? *Ans.* Right.

How subtract each figure in the lower line? *Ans.* From the figure above it.

What set down? *Ans.* Remainder.

If the lower figure is greater than that above it, what do you do? *Ans.* Add ten to the upper figure.

What do then? *Ans.* Take the difference.

What set down? *Ans.* Remainder.

How many carry in all cases when the lower figure is greater than the upper? *Ans.* One.

What do you mean by carrying one? *Ans.* Add one to the next figure.

Which figure, upper or lower? *Ans.* Next lower.

EXAMPLE.

Take 13 from 20. *Ans.* 7. Proof 7 and 13 are 20.
Take 9 from 15. *Ans.* 6. Proof 6 and 9 are 15.
Take 8 from 20. *Ans.* 12. Proof 12 and 8 are 20.
Take 20 from 40. *Ans.* 20. Proof 20 and 20 are 40.
Take 5 from 26. *Ans.* 21. Proof 21 and 5 are 26.

Take 3 from 30. *Ans.* 27. Proof 27 and 3 are 30.
Take 13 from 30. *A.* 17, Proof 17 and 13 are 30.
Take 5 from 11. *Ans.* 6 Proof 6 and 5 are 11.
Take 3 from 13 and prove it.
Take 25 from 50 and prove it.
Take 50 from 100 and prove it.
Take 60 from 100 and prove it.
Take 80 from 100 and prove it.
Take 75 from 100 and prove it.
Take 75 from 80 and prove it.
Take 90 from 100 and prove it.
Take 100 from 200 and prove it
Take 99 from 100 and prove it.
Take 199 from 200 and prove it.
Take 200 from 400 and prove it.
Take 500 from 1000 and prove it.
Take 600 from 1000 and prove it.
Take 999 from 1000 and prove it.

John has 19 chesnuts, and he gives away 11, how many has he left?

John has 75 apples, he gives 20 to his oldest brother, 20 to his youngest, and 20 to his sister; how many has he left?

Harry had 25 marbles in both pockets; he lost 9 out of one pocket, and 7 out of the other; how many has he left?

William has two large pockets, they both will hold 75 peaches, he has in one 15, and in the other 45; how many more will they both hold?

A boy returning with a basket full of oranges, containing 100, and meeting his cousin by the way gave him 20; how many did he carry home?

Two boys playing at marbles, each had 20 when they began; John lost 5, how many did each have then?

When John lost 8 how many did each have?

When the unfortunate boy had lost all, but 2, how many had James won from John?

James and John, counting their peaches, found they had 50; after John had got 14, they agreed to divide the rest, equally between them; how many did each receive?

A man gave his son one dollar to be laid out as he pleased, expecting that it would be devoted to some good use, as had been before, bought one book for 20 cents, one for 30, and one for 40; how much has he left?

80 scholars compose your instructor's school; 25 come from over the bridge, 15 from down town, 20 from up town, and the rest are boarders from out of town; how many belong out of town?

You bought 100 new marbles for 50 cents, and sold Peter 10 for 15 cents, Harry 6 for 10 cents, Thomas 34 for 20 cents; how many marbles have you remaining, and how much more did you give for them, than what you sold come to?

How many quarters to an apple, or any thing?

How many thirds to an apple or any thing?

How many eighths to any thing?

How many sevenths to any thing?

How many sixths, fifths, and ninths, to any thing?

If you had 4 pencils, and should give $\frac{1}{4}$ away how many would you have left?

If you had 3 cents, and should give away $\frac{1}{3}$; how many would you have left?

If you have 8 pencils, and give away $\frac{1}{8}$, how many have you left?

If $\frac{4}{8}$, how many have left?

If $\frac{6}{8}$, how many have left.

If you have 16 marbles, and should part with $\frac{2}{8}$ with $\frac{4}{8}$, and $\frac{8}{8}$; how many left have each time?

If you have 20 cents, and part with $\frac{1}{20}$, how many is that, and how many left?

Suppose you had 30 chesnuts, and should part with $\frac{15}{30}$, how many is that, and how many have left?

John, James, and Harry, had 24 pencils, John says he will take $\frac{6}{24}$ for his part, James takes $\frac{1}{4}$ for his part, and Harry having attended more to fractions than the others, cunningly said, he would take the remainder; which got the most, and how many did each have?

Harry has 12 peaches, and James 24, Harry says that $\frac{1}{3}$ of his, are as many, as $\frac{1}{4}$ of James; did Harry say right, and if not, what is the difference?

Note.—The demonstration in this rule. is subjoined to the rule, and examples, on account of its being more difficult to be comprehended, and may be omitted as well as in the other rules, till the review, especially by younger scholars.

Why do you carry one? *Ans.* For the one ten, which made the ten units, that I added to the upper figure.

What is the ten, which was added by the rule the value of? *Ans.* The figure in the next higher place.

What effect does it have on that, by adding one to the next lower? *Ans.* It makes it one less.

Is the value altered then, by adding 10 to the upper, and carrying, or adding 1 to the next lower figure? *Ans.* It is not.

Give an example of this, by subtracting 3 from 12. *Ans.* 3 from 2, I cant, by adding 10 to 2, I say 3 from 12 leaves 9; the 10 which I added to 2, is the value of the figure 1 in the next upper place, and adding one to the next lower place, has the same effect, as if I had rubbed out the one in the next upper place, and carried none.

Addition and Subtraction of Federal Money.

How place dollars, cents, &c. to be added and Subtracted? *Ans.* Dollars under dollars, dimes under dimes cents under cents, &c.

If the cents are less than 10, how must they be written down with dollars? *Ans.* With a cypher between the cents and dollars.

How add and subtract in Federal Money? *Ans* As in Simple Addition and Subtraction.

Where place the separatrix? *Ans.* Directly under the separating points above.

What is the proof? *Ans.* As in whole numbers.

What will 20 pencils come to, at 5 cents for 10, and 10 dimes for 10?

What is the sum of 50 cents, and 5 dimes?

What is the sum of 6 cents, 12 cents, 20 cents, and 2 dimes?

If you give 25 cents for a top, 25 cents for a knife, one dime for a slate; how much do they all come to?

If you buy a top for 20 cents, 12 marbles for 20 cents, and 6 oranges for 10 cents, and sell them for five dimes; do you make or lose by trading?

Your father gave you 15 mills, 4 mills, 1 mill, 2 dimes, and 28 cents, and said that if you would tell him how much more it would take to make a dollar, he would give you as much more, how much did it take.

How much is $\frac{1}{4}$ of a dollar?

What will 4 yards, of cloth come to, at $\frac{1}{4}$ of a dollars a yard?

What will 2 yards at $\frac{1}{4}$ of a dollar a yard?

What will 3 yards at $\frac{1}{4}$ of a dollar a yard?

If you buy 6 apples for $\frac{1}{4}$ of a dollar, how many can you buy for a dollar, how many for $\frac{1}{2}$ a dollar?

How many for $\frac{3}{4}$ of a dollar?

You bought a yard of ribbon for 24 cents, and gave $\frac{1}{4}$ to your sister, and sold the rest at 10 cents for a quarter of a yard; did you make, or lose? and how much?

John, James, Joseph, and Harry bought a sled for 75 cents, and being inexperienced in figures, except John, who hearing them say, they were willing to pay $\frac{1}{4}$ of a dollar apiece, accepted their proposal, offering to pay the remainder; which gave the best evidence of a knowledge of figures, and how much did John pay?

If 3 dollars buy one yard of cloth, what is $\frac{1}{3}$ of a yard worth?

A, B, and C buy a chaise for 90 dollars, A pays $\frac{1}{3}$ of it; how many dollars do B and C pay?

MULTIPLICATION.

What is the increasing a number, a given number of times called? *Ans.* Multiplication.

Of how many denominations to be Simple Multiplication? *Ans.* One.

How many parts has it? *Ans.* Three.

What are they? *Ans.* Multiplicand, Multiplier, and Product.

What is the number to be multiplied, called? *Ans.* Multiplicand.

What is the number you multiply by, called? *Ans.* Multiplier.

What is the result of the operation, or answer called? *Ans.* Product.

What are both Multiplier and Multiplicand, sometimes called? *Ans.* Factors, or terms.

Which hand begin to multiply? *Ans.* Right.

Why begin at the right? *Ans.* Because figures increase from the right to the left.

How place the figures of the Multiplier? *Ans.* Units under units, tens under tens, &c. of the Multiplicand.

How many carry? *Ans.* One for every ten, as in Addition.

Why? *Ans.* Because ten units make one ten, 10 tens one hundred and so on.

What is the proof? *Ans.* Take one from the multiplier, and multiply by the remainder; then add the multiplicand to this product, and if the sum is equal to the product of the first multiplication, the work is right.

Give an example? *Ans.* 4 times 6 are 24; 1 from 4 leaves 3; 3 times 6 are 18; by adding in the multiplicand 6 it makes 24, the same as the product of the first multiplication.

In multiplying by more figures than one, where place the first figure in each product? *Ans.* Directly under its multiplier.

How are they to be added? *Ans.* As they there stand.

Why do you place the first figure in each product, directly under its multiplier? *Ans*, Because the first figure stands in the place of units, and the second figure in the place of tens, and so on, and must retain those places in the product in order to be added, for tens must be added to tens, hundreds to hundreds, &c.

To illustrate Multiplication, you take into your hand 5 chesnuts 3 times, how many have you had in your hand?

How many are 3 times 5 then?

Which is the multiplicand?

Which is the multiplier?

Which is the product?
How many are 2 times 30?
How many are 1 times 30?
How many are 3 times 15?
How many are 4 times 25?
How many are 2 times 500?
How many are 4 times 500?
How many are 8 times 500?
How many are 10 times 500?
What is the product of 500 multiplied by 10?

Application and use of Multiplication by Federal Money and whole numbers.

Note.—The application of this rule, by examples, which are of daily occurrence, necessarily involves dollars and cents, therefore it was thought best, that it should consist of Federal Money and whole numbers promiscuously.

How is the multiplicand to be written down in Federal Money? *Ans.* As in whole numbers.

If the cents are less than ten; where must a cypher be put in writing them down? *Ans.* In the dimes' place or between the dollars and cents.

How multiply? *Ans.* As in whole numbers.

How many places do you retain in the product, for dimes, cents, and mills? *Ans.* As many as are in the Multiplicand.

EXAMPLES.

What will 20 yards of cloth come to at 1 dollar per yard?

What will 20 yards, at 2 dollars per yard?
What will 20 yards, at 4 dollars per yard?
What will 20 yards at 5 dollars per yard?
What will 6 yards, at 15 cents per yard?

What will 12 yards, at 12 cents per yard?

What will 40 yards, at 10 cents per yard?

What will 4 yards, at 10 dollars per yard?

What will 100 yards, at 5 cents per yard?

What will 500 yards, at 1 dollar per yard?

What will 500 yards, at 5 dollars per yard?

What will 20 yards of tape come to at 5 mills per yard?

What will 20 yards of tape come to in cents, at 3 mills per yard?

What will 20 yards come to at 12 cents and 5 mills per yard?

How many cents is 9d? *Ans.* 12½.

How many 4½d? *Ans.*. 6¼.

How many nine pences in a dollar? *Ans.* 8.

How many fourpence half penny pieces in a dollar? *Ans.* 16.

How many four pence half penny pieces in half a dollar, or 50 cents?

How many nine penny pieces in half a dollar or 50 cents?

What will 8 yards of tape come to, at 9 pence per yard?

What will 16 yards of tape come to at 9 pence per yard?

What will 24 yards come to, at 9 pence per yard?

What will 24 yards come to at 4½ pence per yard?

What will 4 yards come to at 4½ pence or 9 pence per yard?

What will 2 yards come to at 4½ pence or 9 pence per yard?

What will 6 bushels of apples come to at 20 cents a bushel?

What will 40 marbles come to at 2½ cents, or 2 cents and 5 mills a marble?

What will 15 oranges come to, in cents at 2 dimes per orange?

What will 20 oranges come to in cents, at 5 dimes per orange?

What will 4 quarters tuition come to in dollars, at 1 eagle per quarter?

What will 3 quarters tuition come to in dollars at 1 eagle and 5 dollars per quarter?

When any number, or thing is divided into 3 equal parts, what is one of those parts called. *Ans.* Three.

When any thing or number is divided into four equal parts; what is one called? *Ans.* $\frac{1}{4}$.

When any thing, or number is divided into 10 equal parts; how is one of those parts expressed? *Ans.* $\frac{1}{10}$

When any thing, or number is divided into 12, 16, 20, or 50 equal parts; what is one of these parts? *Ans.* $\frac{1}{12}$, $\frac{1}{16}$, $\frac{1}{20}$, and $\frac{1}{50}$.

In the above sum what are 3 of these parts? *Ans.* $\frac{3}{12}$, $\frac{3}{16}$, $\frac{3}{20}$, and $\frac{3}{50}$.

What would eight of the above parts be called? *Ans.* $\frac{8}{12}$, $\frac{8}{16}$, $\frac{8}{20}$, and $\frac{8}{50}$.

If you travel 10 miles in one hour; how far can you travel in 10 hours?

If rum is a dollar a gallon, how much will two barrels come to?

How many hogsheads make 1 tun?

What will one tun of wine come to at 20 dollars per hogshead?

If 1 pound of sugar cost 4 cents, what will 1 quarter come to?

If one hundred weight of hay cost 50 cents; what will one ton cost?

If one pair of shoes cost 30 cents, what will one dozen pair cost?

If one quire of paper cost 25 cents, what will one ream cost?

What will 5 score, or 100lbs. of pork come to at 5 cents per lb.?

How many quarts make a peck? *Ans.* 8.

When an apple, or any thing, or any number is divided into eight equal parts; what is one of these parts called? *Ans.* One eighth, as ⅛.

When a peck, or any thing is divided into eight equal parts, you have said, one of those parts was called an eighth, now when a peck is thus divided, what else can you call one of those parts, besides one eighth? *Ans.* One quart.

Why? *Ans.* Because 8 quarts, or the 8 parts, which I said that a peck was divided into equally, make a whole peck.

If ¼ of a yard of broadcloth cost 5 dollars, what will one yard cost?

What will 2 yards cost?

What will 3 yards cost?

What will 6 yards cost?

If you travel a mile in ½ an hour, how many miles can you travel in one day and night?

If you travel 2 mile in ¼ of an hour, how far can you travel in an hour?

How far in 10 hours?

If the stage fare for 20 miles is 2 dollars, what would it be for 80 miles?

If one yard of cloth cost 12 cents and 5 mills; what will 3 yards cost?

If one orange cost 6 cents, what will 100 cost?

You buy a hogshead of molasses for 10 dollars, 50 cents, what will 3 hogsheads come to?

What will 8 yards of broadcloth come to at 1 dol. and 50 cts. per yd?

Suppose one in your class consisting of 4 boys, buy a Virgil for 1 dollar and 25 cents, how much money would it take for all your class, to buy one apiece?

If 20 cents is the price of a Mental and Practical Arithmetic; how much money will it take to furnish a class of ten with it?

You buy 50 marbles for 3 cents apiece, and sell 40 of them for 4 cents apiece; how many have you got left, and did you sell the 40 for more than you gave for the 50, or not; and if you did for how much more?

To multiply by 10, 100, or 1000 the easiest way: what is the rule? *Ans.* Put as many cyphers to the right of the multiplicand, as there are cyphers in the multiplier. For example:

Multiply 24 by 10.
Multiply 24 by 100.
Multiply 24 by 1000.

What is multiplication, a short way of performing? *Ans.* Several additions.

How many times must the multiplicand be added to itself to do the sum by Addition? *Ans.* As many times as there are units in the multiplier.

What do you mean by units in the multiplier, suppose for instance, that your multiplier is 100, how many units are there in it? *Ans.* 100.

Suppose your multiplicand is 100, and your multiplier 99, how many times would you have to add 100 to itself to get the same answer as in multiplication? *Ans.* 99.

What does this prove? *Ans.* That multiplication is a short way of performing several additions.

DIVISION.

What is the process, by which we find how many times one number is contained in another, called? *Ans.* Division.

What is the process, of finding how many times one number is contained in another of the same kind, or denomination, called? *Ans.* Simple Division.

What do you mean by the same kind? *Ans.* All pounds, all drams, or all shillings, &c.

How many parts is it divided into? *Ans.* 4.

What are they called? *Ans.* Divisor, Dividend, Quotient, and Remainder.

What is that we divide by always called? *A* Divisor.

What is the number to be divided called? *Ans.* Dividend.

What is the result or answer called? *Ans.* Quotient.

What is that which is sometimes left after the sum is done called? *Ans.* Remainder.

What is the remainder less than? *Ans.* Divisor.

Of what sort or denomination is the remainder? *Ans.* Dividend.

If your dividend for instance, is ounces, what is the remainder? *Ans.* Ounces.

To illustrate division you count 9 cents into four parcels, of two in a parcel and one over; what would you call the number of parcels, into which the 9 cts. were divided? *Ans.* Quotient.

What do you call the 9 cents? *Ans.* Dividend.

What do you call the number in each parcel? *Ans.* Divisor.

What do you call the one over? *Ans.* Remainder.

On which hand of the dividend is the divisor to be placed, in doing the sums? *Ans.* On the left.

On which hand the quotient? *Ans.* On the right.

How many left hand figures of the dividend do you take first? *Ans.* As many as the divisor will go in, once, or more.

How many steps are there in Division? *Ans.* 4.

What are they?

1. Find how many times.
2. Multiply.
3. Subtract.
4. Bring down.

After you have subtracted all along in doing the sum; what must the remainder be always less than, every time? *Ans.* Than the divisor.

After you have brought down a figure, if the divisor is not contained in it, what do? *Ans.* Put a cypher in the quotient and bring down another figure.

What do then? *Ans.* As before.

When is your sum done? *Ans.* When all the figures are brought down,

Which terms multiply together in proving your sum? *Ans.* Quotient and Divisor.

For instance, which multiply together in the above illustration by cents?

What do with the remainder, if any in the proof? *Ans.* Add it in.

What add, in the above illustration by cents?

What must the result be like? *Ans.* Dividend.

What must what you have multiplied together and and added, in the sum of illustration be like?

What is division a short way of performing? *Ans.* Subtraction.

How many times does it save subtracting the divisor from the dividend? *Ans.* As many times as there are units in the quotient.

For example divide 24 by 6, how many times must 6 be subtracted from 24 to get the same result as by dividing? *Ans.* 4; as 6 from 24 leaves 18; and 6 from 18 leaves 12; and 6 from 12 leaves 6; and 6 from 6 leaves 0.

How many times was 6 subtracted? *Ans.* As many times as there were units in the quotient.

How many units were there in the quotient? *Ans.* 4, for 6 in 24 4 times.

EXAMPLES.

How many times 2 in 12? *Ans.* 6. Proof 6 times 2 are 12

How many times 4 in 12? *Ans.* 3. Proof 3 times 4 are 12.

How many times 3 in 30? *Ans.* 10. Proof 3 times 10 are 30.

How many times 6 in 36? *Ans.* 6. Proof 6 times 6 are 36

How many times 4 in 48, and the proof?

How many times 9 in 36 and the proof?

How many times 8 in 32, and the proof?

How many times 12 in 96 and the proof?

How many times 12 in 144, and the proof?

How many times 15 in 30, and the proof?

How many times 15 in 60, and the proof?

Divide 25 by 5 and prove it.

Divide 100 by 20, and prove it.

Divide 100 by 10, and prove it.

Divide 100 by 2 and prove it.

Divide 103 by 20, and prove it. *Ans.* 5 and 3 remain, proof 5 times 20 is 100, and 3 make 103.

Divide 27 by 4 and prove it.

Divide 101 by 4 and prove it.

Divide 60 apples equally among 12 boys and prove it.

Divide 144 marbles among 12 boys and prove it.

66 chesnuts are to be divided equally among 11 boys; how many is that apiece?

Four boys found a bag containing 4 silver dollars; how many will they have apiece, if it is divided equally?

In the above sum suppose the 2 largest boys should divide it equally among themselves; how many would it be apiece, and the proof?

You buy 20 yards of cloth for 40 dollars, how much is it a yard?

You have in five baskets 20 mellons, and they all hold an equal number, how many are in each basket, and the proof?

A father told his son that he put in the cellar last year, 60 bushels of potatoes: said the father, if you will tell me how many three bushel baskets full of potatoes it will hold, I will give you what one bushel comes to when sold; the boy said 25 baskets, did he get his bushel and if not, how many did his answer differ from the true one?

A boy had 50 marbles, he kept 10 himself and divided the rest equally among four other boys; how many did he give them apiece?

Four boys have 2 parcels of chesnuts; in one parcel there are 48, in another 24 and each parcel is to be divided equally among them; how many will each have in all?

Six boys drew in a pin lottery at one time 60 pins, at another time 24 pins; how many did each have after deducting 24 for what their tickets cost; if the pins are divided equally?

A man gave his 4 sons a calf, telling them, they might have what it would come to, well fatted when it was 3 years old, if they would take good care of it, and they might keep it as well as they pleased; it was sold for 60 dollars, how much did each receive?

Three men travelling together found a pocketbook containing 50 dollars, they agreed to advertise it, which would cost 2 dols. and if no owner appeared, to divide the money equally between them; what did each receive after paying for the advertisement?

If 28 pounds of tea cost 28 dollars, what will one pound cost?

What will 2 pounds cost?

What will 4 pounds cost?

What will 6 pounds cost?

What will 20 pounds cost?

What will 27 pounds cost?

What is 1 cwt. of hay worth, when a ton is worth 40 dollars?

What is 4 cwt. worth?

What is 10 cwt. worth?

What is 1 qr. worth?

What is 2 qrs. worth?

What is 4 qrs. worth?

What is 1 qr. or 28 pounds worth?

What is 14 lbs. worth?

What is 7 pounds worth?

What is 3½ pounds worth then, in pence and cents when hay is 40 dols. a ton?

If you give 16 cents for a pound of sugar how much is 1 oz. or $\frac{1}{16}$, the nmber of parts a pound is drawn into, worth?

How much is $\frac{2}{16}$ worth?

How much is $\frac{4}{16}$ worth?

How much is $\frac{8}{16}$ worth?

How much is $\frac{12}{16}$ worth?

You recollect that a pound of sugar was divided into 16 ounces, or 16 parts, and you have found how much 12 oz. or 12 parts, that is $\frac{12}{16}$ comes to, now I wish you to tell me how much the remaining parts of the pound are in fractions, and what they come to?

You told me in Multiplication, that a dollar was divided into 8 ninepences, or eight parts, and into

16 fourpences half pence, or 16 parts, now tell me in pence and cents how much $\frac{1}{16}$ of a yard of cloth will come to, at 1 dollar per yard?

What will $\frac{1}{6}$ of a yard come to at 1 dollar a yard, in pence and cents?

What will $\frac{2}{8}$ in pence and cents?

What will $\frac{4}{8}$, in pence and cents?

What will $\frac{6}{8}$, in pence and cents?

What will $\frac{2}{16}$ of a yard come to at 1 dollar pet yard?

What will $\frac{4}{16}$ of a yard, come to?

What will $\frac{8}{16}$ come to?

What will $\frac{12}{16}$ come to?

When a number, or any thing is divided into 16, or any number of parts, how would you express all these parts in fractions? $\frac{16}{16}$ or $\frac{5}{5}$.

How much are $\frac{5}{5}$ or $\frac{6}{6}$ or $\frac{50}{50}$: &c. always equal to? *Ans.* The whole or one

How prove it to be the whole? *Ans.* If a number, an apple, or any thing, be divided into 5 parts, or 6 parts, or 50 parts &c. and as 1 part is $\frac{1}{5}$, $\frac{1}{6}$ or $\frac{1}{50}$, it is plain that $\frac{5}{5}$ or $\frac{6}{6}$ or $\frac{50}{50}$ must make the whole for the whole was divided into 5 &c. equal parts and, the sum of all the parts is equal to the whole

To illustrate this by an apple, cut an apple or any thing into 4 or 6 equal parts, 1 part is $\frac{1}{4}$, or $\frac{1}{6}$, then how many parts, or how much of the apple would be denoted by $\frac{4}{4}$ or $\frac{8}{8}$.

How much will $\frac{8}{8}$ of a yard of broadcloth come to at 10 dollars a yard?

You buy $\frac{1}{10}$ of a yard of cloth which is 10 dollars a yard, and sell it at the rate of 30 dollars a yard, how much do you make in trading?

How many figures cut off at the right hand to divide by 10, 100, or 1000, &c.? *Ans.* As many as there are cyphers in the divisor.

What are the figures cut off? *Ans.* Remainder.

What are the other figures? *A.* Quotient, or Answe

Divide 365 by 10, and tell me the quotient. and remainder.

Divide 125 by 100.

Divide 1255 by 1000.

Division of Federal Money.

How is the given sum or dividend to be written down? *Ans.* In cents.

How do you divide? *Ans.* As in whole numbers.

What will your answer or quotient come out in? *Ans.* Cents.

Suppose you had one figure in your dividend, in mills, or add one cypher in dividing, how many figures at the right hand of the quotient do you call mills? *Ans.* One.

If 4 yards of cloth cost 4 dimes and 8 cents; how much is it a yard?

If you give 2 dimes and 5 cents, for 2 slates; how much are the slates apiece?

If 2 yards of ribbon cost 4 dimes, and 8 cents; how much will 1 yard cost?

Two sticks of twist, cost 12 cents 5 mills, what can you get one stick for?

In fractions, what is the figure above the line called? *Ans.* Numerator.

What the figure below the line? *Ans.* Denominator.

To Multiply by Mixed Numbers.

How multiply by a mixed number, or a whole number with a fraction joined to it: as $4\frac{1}{2}$, $4\frac{3}{4}$, $5\frac{150}{500}$, &c.? *Ans.* Multiply by the whole number first,

Where write the multiplicand to multiply by the fraction? *Ans.* In another place.

Which part of the fraction do you multiply by when so written? *Ans.* The numerator or figure above the line.

What divide by? *Ans.* The denominator or figure below the line.

What is the quotient to be added to? *Ans.* To the product of the whole numbers.

For example, to multiply 28 by $2\frac{5}{7}$. what do you multiply first by?

How much does it make?

How write 28?

What multiply it by?

What divide by?

What add the quotient to?

A boy bequeathed to his companion $\frac{3}{4}$ of his 20 marbles; how many did he bequeath?

A boy gives you $\frac{1}{3}$ of his 60 chesnuts, how many is that?

Tell me how many yards 5 rods are, or multiply 4 by $5\frac{1}{2}$.

Tell me how many gallons 2 barrels make, or multiply 2 by $31\frac{1}{2}$.

Now let us see if we can explain why we divide in multiplying by a fraction? for doubtless it has appeared rather strange.

In multiplying by a whole number we take the multiplicand as many times as there are units in the multiplier; and in multiplying by one then, how many times do you take the multiplicand? *Ans.* 1.

Give an example :

Now it is plain that if we multiply by any thing less or more than 1, the product will not be the same as multiplying by 1· what will it be then if we multiply by any thing less than one? *Ans.* Less than if multiplied by one.

How can you find out how much it will be? *Ans,* By Division.

To multiply by $\frac{1}{2}$ for instance explain how it is done. *Ans.* As I take the multiplicand once in multiplying by 1, so I must take $\frac{1}{2}$ of one to multiply by $\frac{1}{2}$ for the multiplier is $\frac{1}{2}$ of one, and the multiplicand must be taken half as much; and in that proportion, in multiplying by any other number.

To divide by a whole number joined with a fraction (that is a mixed number;) as $2\frac{1}{2}$, $2\frac{3}{4}$, $5\frac{21}{42}$? *Ans.* Multiply the whole number of the divisor by the denominator, add in the numerator, then multiply the dividend by the same denominator, divide and the quotient will be the answer

For example, how divide 5 by $2\frac{2}{4}$? 4 times 2 are 8 and 2 are 10: 4 times 5 are 20; 10 in 20,2 times, the answer.

Divide 11 yards by $5\frac{1}{2}$ yards, or bring 11 yards into rods.

Divide 7 by $1\frac{2}{5}$.

Divide 8 by $1\frac{1}{2}$.

Divide 10 by $2\frac{5}{10}$.

To multiply by any large number readily in the head, without the assistance of slate &c. by 24 and under. *Ans.* Double the multiplicand and half the multiplier.

Multiply 500 by 24. *Ans.* Double of 500 is 1000, and half of 24 is 12, then 12 times 1000 are 12000.

COMPOUND ADDITION.

What is the adding sums of the same general nature; but of different denominations, into one sum or amount called? *Ans.* Compound Addition.

Wherein does Compound Addition differ from Simple? *Ans.* Simple consists of only one denomination, Compound of more than one.

What do you mean by different denominations

Ans. Shillings, pence, farthings, &c. in one sum and tons, cwts. qrs. ounces, &c. in another sum.

How place the numbers to be added? *Ans.* Pounds under pounds, shillings under shillings, tons under tons, &c.

Which hand begin to add? *Ans.* Right.

With which denomination? *Ans.* The lowest.

How add it up? *Ans.* As in Simple Addition.

How many of this denomination do you divide it by? *Ans.* By as many as make one of the next higher.

What set down? *Ans.* Remainder.

What carry? *Ans.* The quotient.

How long continue to do so? *Ans.* Till I come to the last row.

What do with that? *Ans.* Set down the whole amount without dividing.

What is the proof? *Ans.* the same as in Simple Addition.

What reason can you give for carrying in the compound rules so differently from the simple rules? *Ans.* In Simple Addition 10 units made one ten or one in the next left hand place, now sometimes 20 shillings, sometimes 20 cwt. and sometimes 16 ounces &c. make one in the next higher place, as much as ten units did,

For example, What is the sum of 2 tons, 15 cwt. and 1 ton, 5 cwt.

What is the sum of £2, 2s. 2d. 2qr. and £10, 10s, 10d?

If a man owed you £3, and afterwards borrowed 15 shillings more, how much does he now owe you?

You lent a man 2 qrs. 16 lbs, of sugar, and afterwards lent him 12 lbs. more, how much did borrow of you in all?

COMPOUND SUBTRACTION.

What rule tells the difference between two numbers of the same general nature, but divided into various denominations? *Ans.* Compound Subtraction.

Wherein does Compound Subtraction differ, from Simple? *Ans.* Simple consists of only one denomination, Compound of different or more than one.

How are the several denominations to be placed? *Ans.* As in Compound Addition.

How is that?

Which is always to be placed under the greater? *Ans.* The less.

Which denomination begin with? *Ans.* The lowest.

How many units do you borrow, if it exceed the figure over it? *Ans.* As many, as make one of the next higher denominations.

What next? *Ans.* Subtract it therefrom.

What add the difference to? *Ans.* The upper figure.

What set down? *Ans.* The sum or amount.

How long continue to do so? *Ans.* To the last denominator.

How subtract that? *Ans.* As in simple subtraction.

What is the proof? *Ans.* As in Simple Subtraction.

A man owes you 1 pound and 19 shillings, and pays you 18 shillings, how much remains unpaid?

A man owes you 1£, 19s. 12d, and pay you 1d, how much remains unpaid?

You borrow of a man 1£, 20s. 12d, and pays one farthing; how much more ought he to demand of you?

Harry lent you 1£, and you returned 1 farthing of it; how much is his due now?

COMPOUND MULTIPLICATION.

Wherein does compound differ from Simple Multiplication? *Ans.* Simple consists of only one denomination. Compound of more than one, or different denominations.

What is Compound Multiplication then? *Ans.* It is the multiplying numbers of different denominations, by a single number.

Under which denomination is the multiplier to be placed? *Ans.* The smallest.

How multiply each denomination? *Ans.* Separately, as in Simple Multiplication.

How divide the product, and carry? *Ans.* As in Compound Addition.

What is the proof? *Ans.* As in Simple Multiplication,

Note.—Examples are omitted in this, and some other rules, as being too difficult to be performed, without the use of the slate.

COMPOUND DIVISION.

Wherein does Compound Division differ from Simple? *Ans.* Simple consists of only one denomination, Compound of more than one, or different denominations.

What is Compound Division then? *Ans.* It is the process of finding how many times, one number is contained in another, of different denominations.

With which denomination do you begin to divide? *Ans.* The highest.

How divide it? *Ans.* As in Simple Division.

If you have a remainder what do you multiply it by. *Ans.* By as many of the next lower denomination, as make one of this

What add in? *Ans*. The next denomination is the dividend, if there be any.

How divide then? *Ans.* As in Simple Division.

How proceed, after this, to finish your sum? *Ans.* As before.

What is the proof? *Ans.* The same, as in Simple Division.

REDUCTION.

What is the process of changing numbers, from one denomination to another, without altering their value, called? *Ans.* Reduction.

How does this affect the value? *Ans.* It does not alter it.

How do you prove this? *Ans.* Take a large piece of paper, and call it one pound, then cut this pound into shillings, or 20 pieces, (which is the same as multiplying by 20,) consequently, there are 20 shillings in one pound, or 20 shillings are equal to one pound.

Now take these 20 shillings, and cut them into pence, or 12 pieces each (which is the same as multiplying the 20 shilling by 12 pence,) and count them, there are 240 pieces; that is 240 pence in one pound; hence the value is not altered.

How many kinds of Reduction are there? *Ans.* Two.

What are they? *A.* Descending and Ascending.

What is the changing larger denominations into smaller called? *Ans.* Reduction Descending.

Give an example:

Tons into drams, pounds into farthings, &c.

What is it performed by? *Ans.* Multiplication.

What is the changing smaller denominations into larger, called? *Ans.* Reduction Ascending

Give an example. *Ans.* Drams into tons, farthings into pounds, &c.

What is this performed by? *Ans.* Division.

In Reduction Descending, how do you multiply the highest denomination given? *Ans.* By as many of the next denomination as it takes to make one of this.

What add in? *Ans.* The next denomination in the sum, if there be any.

How long proceed in this way? *Ans.* Till it is brought to the denomination required!

What is the proof? *Ans.* Divide by your last multiplier and so on.

For example; how multiply pounds? *Ans.* By shillings.

How multiply shillings? *Ans.* By pence.

How multiply cwts.? *Ans.* By qrs.

What do you multiply by, to bring 25 pounds into farthings? *Ans.* By 20s. 12d. and 4 qrs.

What to bring one hundred weight into pounds?

What to bring one hundred weight into ounces?

What to bring one hundred weight into drams?

What to bring one ton into drams?

What to bring one pound into grains?

What to bring one Ell French into nails?

What to bring one Ell Flemish into nails?

What to bring one Ell English into nails?

What to bring 5 bushels into pints?

What to bring 10 tuns into gills?

What to bring 360 degrees into inches?

What to bring 640 square acres into square feet?

What to bring 20 solid feet into solid inches?

What to bring weeks into seconds?

What to bring 6 signs into minutes?

What multiply by, to tell how many seconds old you are, allowing 365 days to the year?

What multiply guineas by, to bring them into shillings? *Ans.* By 28.

How multiply to bring 10£, 0s. 5d, into farthings?

How multiply to bring 5 years, 20 days, 15 hours, 30 minutes, and 40 seconds into seconds?

What multiply 360 degrees by to tell how many barley corns will reach round the world?

How divide in Reduction Ascending? *Ans.* By as many of that denomination as make one of the next higher.

How long continue to do so? *Ans.* Till it is brought to the denomination required.

What denomination is the remainder of? *Ans.* The dividend. How divide shillings, as a general rule? *Ans.* By shillings.

How divide pence? *Ans*, By pence.

How drams? *Ans.* By Drams.

How ounces? *Ans.* By Ounces.

How do you prove Reduction Ascending? Multiply by your last divisor and so on.

How bring 1000 farthings into pounds; that is, what divide by?

How bring 1000 pounds into hundred weights?

How bring 46000 ounces into quarters?

How bring 600 grains into ounces?

How bring 50 quarters into Ells Flemish?

How bring 75 quarts into bushels?

How bring 1200 gallons into hogsheads?

How bring 540 yards into rods?

How bring inches into acres?

How bring 1000 solid inches into cords of wood?

How bring 1000 hours into days, and months?

How bring 1000 minutes into signs?

How bring shillings into guineas, of 28 shillings each?

How bring shillings into dollars?

Suppose you are 500000000 seconds old; how can you tell, how many years old you are?

REDUCTION OF FEDERAL MONEY.

How bring Eagles into dollars? *Ans.* Annex 2 cyphers.

How into cents? *Ans.* Annex 3 cyphers.

How into mills? *Ans.* Annex 4 cyphers.

How bring dollars into dimes? *Ans.* Annex 1 cypher.

How bring dollars into cents? *Ans.* Annex 2 cyphers.

How bring dollars into mills? *Ans.* Annex 3 cyphers.

How bring mills into Eagles? *Ans.* Cut off four figures for mills, or 1 for dollars, 2 for cents, and 1 for mills.

How bring mills into dollars? *Ans.* Cut off 3 figures for mills, or 2 for cents and 1 for mills.

How bring mills into dimes? *Ans.* Cut off 2 figures for mills, or 1 for cents and 1 for mills,

How bring mills into cents? *Ans.* Cut off one figure for mills.

How bring cents into dollars? *Ans.* Cut off 2 figures, or remove the separatrix.

How bring dollars into cents then? *Ans.* Annex 2 cyphers, or remove the separatrix.

For example; how many cents, are 2 dollars? *Ans.* 200 cents.

Bring 500 cents into dollars. *Ans.* 5 dollars.

Bring 4 dollars 25 cents, into cents. *Ans.* 425.

Bring 5 dollars 25 cents, into cents. *Ans.* 525.

Bring 4 dollars 15 cents into cents. *Ans.* 415.

If the cents are less than ten; what must be done in writing them down? *Ans.* Place a cypher between the dollars and cents.

For example: how write down 4 dollars, 1 cent, in cents? *Ans.* 401 cents.

How write down 25 dollars and 4 cents? *Ans.* 25,04 cents.

FRACTIONS.

What are parts of whole numbers called? *Ans.* Fractions.

How many kinds? *Ans.* Two.

What are they? *Ans.* Vulgar and Decimal.

How is a Vulgar Fraction expressed? *Ans.* By two numbers. placed one above another, with a horizontal line between them.

What is the number below the line called? *Ans.* Denominator.

What is the number above the line called? *Ans.* Numerator.

Which shows how many parts an apple or any, thing, is divided into? *Ans.* Denominator.

Which shows how many, of those parts are taken? *Ans.* Numerator.

To illustrate; take an apple, and cut it into 4 equal parts, and give away two parts; now which is the denominator and which is the numerator?

How would you express what you gave away in fractions? *Ans.* $\frac{2}{4}$ or two fourths.

If you own $\frac{28}{40}$ of a vessnl, how many parts is the vessel divided into? *Ans.* 40.

If the same vessel wss divided into 16 parts, and you own 8 of them; how would you express it in fractions? *Ans.* $\frac{8}{16}$.

What part do you own, $\frac{1}{2}$, or $\frac{3}{4}$: *Ans.* $\frac{1}{2}$

How prove that it is $\frac{1}{2}$? *Ans.* If a vessel is divided into 16 parts and I own 8, I own $\frac{1}{2}$, for 8 is $\frac{1}{2}$ of 16.

If a building is divided into 24 parts, and James owns 3 parts, Thomas 9 parts, how would these parts be expressed? *Ans.* $\frac{8}{16}$, $\frac{3}{16}$.

Would you two own the whole? *Ans.* Not but $\frac{1}{2}$.

How many parts would you two own? *Ans.* $\frac{12}{24}$.

If Harry should buy 3 parts; how would his part be expressed? *Ans.* $\frac{3}{24}$.

How much would you all three own. *Ans.* $\frac{15}{24}$.

Suppose William should buy 6 parts, how would you express his part? *Ans.* $\frac{6}{24}$.

How many are all your parts added together? *Ans.* 21.

How express them in fractions? *Ans.* $\frac{21}{24}$

Suppose Stephen should buy 3 parts more; what part would you all own then?

How prove that? *Ans.* 3 more make 24, the number of parts the building was divided into, in the first part.

Does multiplying the numerator, and denominator by the same number, alter the value? *Ans.* It does not.

Does dividing both numerator and denominator by the same number alter the value? *Ans.* It does not.

How prove that? *Ans.* It has been proved that $\frac{8}{16}$ is $\frac{1}{2}$, now multiply 1 by 8, and 2 by 8, and the expression will be $\frac{8}{16}$, which is equal to $\frac{1}{2}$; so divide both 8 and 16 by the same number 8, and the result will be $\frac{1}{2}$; hence the value is not altered.

How must a fraction be divided to reduce it to its lowest terms? *Ans.* By any number that will divide both numerator, and denominator, without a remainder, and the quotient again, as before and so on.

When is it said, to be reduced to its lowest terms?

Ans. When there is no number, greater than one that will divide them both without a remainder.

Give an example. *Ans.* $\frac{4}{8}$ reduced to its lowest terms, is one half.

In reducing fractional parts of weights, measures &c. to their proper denominations, how multiply the numerator? *Ans.* By as many of the next denomination, as make *one* of which the fraction is a part.

What divide by? *Ans.* Denominator.

How long continue to do so? *Ans.* Till through with all the denominations.

For example; how multiply and divide $\frac{7}{8}$ of a pound? *Ans.* By 20 and divide by 8.

How $\frac{7}{24}$ of a day to reduce it to its proper quantity? *Ans.* By 24 hours, and so on.

How reduce $\frac{1}{4}$ of a day, to its proper quantity? How reduce $\frac{1}{6}$ of a mile to its proper quantity?

How $\frac{3}{7}$ of a minute to is proper quantity?

DECIMAL FRACTIONS.

How are whole numbers supposed to be divided in Decimal Fractions? *Ans.* Into tenths, hundredths, thousandths, tens of thousandths, &c.

How are they expressed in figures? *Ans.* By placing a point before them.

What is the point prefixed called? *Ans.* Separatrix.

How may the denominator always be known? *Ans.* By annexing as many cyphers to the figure 1 as there are decimal figures.

Give an example. *Ans.* ,5 ,55 ,555.

What is the denominator? *Ans.* 10, 100, 1000.

To illustrate; suppose one whole number, or an apple is divided into ten equal parts, 5 means five of those parts.

Suppose an apple, or any thing is divided into 100 equal parts; what would 75 mean? *Ans.* 75 of those parts.

How would it be written? *Ans.* With a point before it, thus ,75.

Which hand begin to numerate? *Ans.* Left.

Do Decimals increase or decrease, from this hand? *Ans.* Decrease.

In what proportion? *Ans.* Ten fold.

What is the first figure on the right of the separatrix, called? *Ans.* Tens.

What the next, and so on? *Ans.* Hundredths, &c. as in the numeration table.

To illustrate, what does the first figure on the left of the following decimal mean, ,111? *Ans.* One tenth part of a whole number.

What does the second? *Ans.* One hundredth part of the whole.

What the third?

Do you begin at the same hand to numerate in decimals as in whole numbers? *Ans.* I do not.

Tell how you begin in both.

What place in decimals does the separatrix take the place of in whole numbers? *Ans.* Units.

What is the value of a cypher, placed at the right of decimals? *Ans.* No use.

What use placed at the left? *Ans* It decreases the value of the decimal.

In what proportion? *Ans.* Tenfold.

To illustrate; what does ,5 ,50 ,500 and ,05 ,005 mean? *Ans.* ,5 means $\frac{5}{10}$, ,50 means $\frac{5}{10}$ and no hundredths, and ,500 means $\frac{5}{10}$, no hundredths and no thousandths, and ,05 means no tenths, and $\frac{5}{100}$,005 means no tenths, no hundredths but $\frac{5}{1000}$ and as $\frac{5}{100}$ is ten times less than $\frac{5}{10}$; hence the value is decreased, in a tenfold proportion

ADDITION OF DECIMALS.

How is the sum to be written down? *Ans.* Tens under tens, hundreds under hundreds, and so on.

How add? *Ans.* As in Simple Addition.

Where place the separatrix? *Ans.* Directly under the separating points above.

What are the numbers on the right of the separatrix? *Ans.* Decimals.

What are the numbers on the left? *Ans.* Whole numbers.

What are the numbers in the other decimal rules? *Ans.* As in this.

What is the proof? *Ans.* The same as in Simple Addition.

EXAMPLE.

What is the sum of ,2 and ,35? *Ans.* ,55.
What is the sum of ,5 and ,125? *Ans.* ,625.

SUBTRACTION OF DECIMALS.

How write the decimals down? *Ans.* As in Addition.

How subtract? *Ans.* As in simple subtraction.

How place the separatrix? *Ans.* As in Addition of Decimals.

How prove your sums? *Ans.* As in Simple Addition of Decimals.

EXAMPLES.

From ,6 take ,15. *Ans.* ,45.
From ,5 take ,25. *Ans.* ,35.
From ,1 take ,01. *Ans.* ,09.
From 1 take ,9. *Ans.* ,1.

MULTIPLICATION OF DECIMALS.

How write down the decimals, and multiply? *Ans.* As in Simple Multiplication.

How many decimals point off in the product? *Ans.* As many, as are in both multiplicand, and multiplier.

If there should not be so many decimals in the product, what do you do? *Ans,* Prefix cyphers enough to make as many.

What is the meaning of prefix? *Ans.* To put before.

What is the meaning of annex? *Ans.* To put after.

For example.

Multiply ,15 by 2. *Ans.* ,3.
Multiplv ,8 by ,7. *Ans.* ,56.
Multiply ,25 by 2. *Ans.* ,5.
Multiply ,25 by ,2. *Ans.* ,05.
Multiply ,25 by ,1. *Ans.* ,025.
Multiply ,25 by ,4. *Ans.* ,1

DIVISION OF DECIMALS.

How write down the sum, and divide? *Ans.* As in Simple Division.

How many point off in the quotient? *Ans.* Enough to make as many decimals in the divisor, and quotient, as there are decimals in the dividend.

Suppose there are not figures enough in the quotient for this purpose, what do then? *Ans.* Make up the deficiency by prefixing cyphers to said quotient.

What do if the quotient is not contained in the dividend? *Ans.* Annex cyphers.

What place do these cyphers take in the dividend? *Ans.* Decimal places

For Example.

Divide ,24 by ,6. *Ans.* ,4.
Divide .36 by ,9. *Ans.* ,4.
Divide ,16 by ,2. *Ans.* ,8.
Divide, 24 by ,6. *Ans.* ,04.

Divide ;36 by ,9. *Ans.* ,04.
Divide ,16 by ,2. *Ans.* ,8.

REDUCTION OF DECIMALS.

CASE. I.

How do you reduce a Vulgar Fraction to its equivalent Decimal? *Ans.* Annex cyphers to the numerator, and divide by denominator.

What is the answer? *Ans.* The quotient.

Suppose there are not so many figures in the quotient, as you have annexed cyphers, what do? *Ans.* Prefix cyphers to the left hand of the quotient.

EXAMPLES.

Reduce $\frac{1}{2}$ to its equivalent decimal,. *Ans.* ;5.

Reduce $\frac{3}{4}$ to its equivalent decimal. *Ans.* ,75.

How reduce a Decimal to a Vulgar? *Ans.* It is a vulgar fraction when its own denominator is written under it.

For example, change ,5 into a Vulgar Fraction. *Ans.* $\frac{5}{10}$.

Now change $\frac{5}{10}$ into a decimal? *Ans.* Take away 10 and prefix the separatrix or divide 5 by 10 annexing a cypher.

How prove that the value is not altered, by the change? *Ans.* $\frac{1}{2}$ reduced to a proper decimal is ,5 and ,5 means five tenths of any thing; consequently if any thing is divided into ten parts, 5 of these must be $\frac{1}{2}$.

CASE. II.

To find the value of any given decimal parts of weights measures &c.

How do you multiply? *Ans.* By as many of the next denomination, as make one of this.

How many figures point off in the product, for the decimal remainder? *Ans.* As many as are in the multiplicand.

How proceed then? *Ans.* As before.

Where will you find your answer? *Ans.* The several denominations on the left hand, make the answer.

For example; what multiply ,365 of a pound by first? *Ans.* 20 shillings, or what makes a pound.

What multiply ,427 of a shilling by first? *Ans.* By 12 pence.

CASE. III.

To reduce quantities composed of several denominations to a decimal, that is to reduce the several denominations found by the preceding rule back again to a decimal.

How place the several donominations? *Ans.* One above the other.

Which at the top? *Ans.* The lowest.

How divide each denomination beginning at the top? *Ans.* By as many as make one of the next, or shillings by shillings, pence by pence, drams by drams, &c.

What is the answer. *Ans.* The last quotient.

Reduce ½d to the decimal of a penny. *Ans.* ,5.

Reduce 10s. to the decimal of a pound. *Ans.* ,5.

Reduce 15s. to the decimal of a pound. *Ans.* ,75.

What divide 3 farthings by, to reduce them to the decimal of a pound? *Ans.* By 4, 12, and 20.

Reduce 3 shillings to the decimal of a dollar. *Ans.* 5 dimes or 50 cts.

Is the value altered in the reduction? *Ans.* It is not.

How prove this? *Ans.* 3 shilling are equal to 50 cents.

How can you ascertain whether your sum is right, or not? *Ans.* I said that 10 shillings reduced to a decimal, was ,5, now multiplying ,5 by the divisor 20 and cutting off according to the rule, I have 10 shillings.

FEDERAL MONEY.

Note.—Federal Money is inserted again to show the scholar the rise and origin of it, and that it is purely decimal.

What is the coin of the United States called? *Ans.* Federal Money.

When established. *Ans.* A. D. 1786.

By what authority? *Ans.* Congress.

Repeat the denominations of Federal Money.

Note.—They are found among the tables at the beginning of the book.

Which is the money unit? *Ans.* Dollars.

What places do dollars occupy then? *Ans.* The place of units.

How are dollars distinguished from dimes, cents, and mills? *Ans.* By a comma, or separatrix at the right of dollars.

What are all the figures on the left of dollars? *Ans.* Eagles.

What is the first figure on the right of dollars? *Ans.* Dimes.

What is the 2d figure? *Ans.* Cents,

What is the 3d figure. *Ans.* Mills.

How many of these coins are real? *Ans.* 4.

Name them? *Ans.* The eagle, the dollar, the dime and the cent.

Which is a gold coin? *Ans.* The eagle.

Which are silver coins? *Ans.* The dollar and the dime.

Which is a copper coin? *Ans.* The cent.

Which is imaginary? *Ans.* The mill, as there is no piece of money of that denomination.

As Federal Money is in a tenfold proportion what are eagles, and dollars both together called in accounts? *Ans* Dollars.

What are dimes, and cents, called? *Ans.* Cents.

How is the Addition, Subtraction, Multiplication, and Division of Federal Money, performed? *Ans.* As in Addition, Subtraction, Multiplication, and Division of Decimal Fractions.

Note.—The scholar should be required to repeat here, the rule for pointing off in Multiplication, and Division of Decimals, that he may more fully understand the following examples.

How much do ,05 make multiplied by ,05. *Ans.* ,0025.

How much do 5 cents multiplied by 5 cents make? *Ans.* 2 mills, and $\frac{5}{10}$.

How much do 25 cents make multiplied by 2 cents? *Ans.* 5 mills.

How much do 10 dollars make, multiplied by 10 cents. *Ans.* 1 dollar.

How much do 5 dollars, make multiplied by 20 cents. *Ans.* 1 dollar.

What is the quotient of ,0025 divided by ,05. *Ans.* ,05.

What is the quotient of 2 mills and $\frac{5}{10}$ m. or ,0025 divided by 5 cents? *Ans.* 5 cents.

What is the quotient of ,005 or 5 mills divided by ,02 or 2 cents. *Ans.* 25 cents.

What is the quotient of 1 dollar divided by 10 cents? *Ans.* 10 dollars.

What is the quotient of 10 mills, divided by 10 mill? *Ans.* 1 dollar.

What is the quotient of 1 cent divided by 1 cent? *Ans.* 1 dollar.

What is the quotient of one dime divided by one dime? *Ans.* 1 dollar.

Note.—It may be a pleasing exercise, to prove the foregoing sums, as it is easily done by the rule for proving Simple Multiplication and Division, observing to point off according to the rules in Decimal Fractions.

REDUCTION OF DECIMALS.

Are pounds, shillings, and pence, the same value in all countries? *Ans.* The value differs in different countries.

How was the value formerly in England and her American colonies? *Ans.* The same.

What occasioned this variety of value? *Ans.* The legislatures of these colonies emitted, or put in circulation bills which depreciated in various degrees.

How many shillings a dollar in the New-England States, Virginia, Kentucky, and Tennessee? *Ans.*6.

How many New-England States are there? *Ans.*6.

Name them. *Ans.* New-Hampshire,
Massachusetts,
Rhode-Island,
Connecticut,
Vermont.
Maine.

How many shillings a dollar in New-York and North Carolina currency? *Ans.* 8.

How many shillings a dollar in New Jersey, Pennsylvania, Delaware, and Maryland currency? *Ans.* 7s. 6d.

How many shillings a dollar in South Carolina, and Georgia currency? *Ans.* 4s. 8d.

How many shillings a dollar in Nova Scotia, and Canada currency? *Ans.* 5 shillings.

How many shillings a dollar in sterling money? *Ans.* 4s. 6d.

To reduce the currencies of the different States, or any currency to Federal Money, how do you do? *Ans.* Bring it into shillings, pence, &c. so that you can divide shillings by shillings, &c. and divide too by the whole number of shillings, pence, or farthings in a dollar.

Note.—It has been thought best to give one general rule for the reduction of all currencies, although it may be somewhat longer, that the learner may avoid the perplexity, and confusion, arising from a multiplicity of rules, when one will solve all the questions.

EXAMPLES.

How do you bring £100 New Jersey currency into dollars? *Ans.* Multiply by 20 and 12; then divide by 90, the pence in 7s. 6d.

How bring £100 sterling, to Federal Money. *Ans.* Multiply by 20 and 12; then divide by 54, the pence in 4s. 6d.

SINGLE PROPORTION, OR RULE OF THREE.

What is the process, by which the use of three numbers known, teaches to find a fourth, which is supposed to be unknown, called? *Ans.* Single Proportion, or Rule of Three.

Of how many kinds is it? *Ans.* 2.

What are they? *Ans.* Rule Three of direct and Inverse.

When more requires more, or less requires less which rule is the sum in? *Ans.* Rule of Three Direct.

When does more require more? *Ans.* More requires more, when the third sum is *more* than the first, and requires the fourth term, or answer, to be *more* than the second.

When does less require less? *Ans.* Less require less, when the third term is *less* than the first, and requires the fourth term, or answer, to be *less* than the second.

What is the fourth number called when found? *Ans.* The answer.

In stating your sum, what must the middle, or second term be like? *Ans.* The answer.

For instance, suppose your answer is money, what must your middle term be? *Ans.* Money.

Suppose it is some denomination in Troy Weight, what must the middle term be? *Ans.* Some denomination in that weight.

What term must you make that number that bought, cost, or produced the second? *Ans.* The first.

In the following sum, you buy a hogshead of molasses for 6s. 9d. per gallon, how much will it come to, and which do you make the first term in stating? *Ans.* 1 gallon.

Why? *Ans.* Because 1 gallon cost 6s. 9d.

What make the middle term? *Ans.* 6s. 9d.

Why? *Ans.* Because the answer is to be money.

What make the third term? *Ans.* 1 hogshead or 63 gallons.

Why? *Ans.* Because the third term must be like the first.

How must the first and third be brought if of differnt denominations? *Ans.* To the same denomination.

How reduce the middle term? *Ans.* To the lowest denomination in it.

Which terms multiply together? *Ans.* The second and third.

Which divide by! *Ans.* The first·

What will your answer come out in? *Ans.* In the same denomination, the middle term was left in.

For example: suppose your middle term was left in seconds, what is your answer in? *Ans.* Seconds.

Suppose you have a remainder in dividing, what must you do? *Ans.* multiply by as many of the next denomination, as make one of this.

How may the denomination, which the answer came out in be brought? *Ans.* Into any other required.

In proving your sums, what make the first term? *Ans.* The answer.

What make the second term? *Ans.* The Third.

What make the third? *Ans.* The second.

How proceed then? *Ans.* Multiply and divide as in doing the sum.

How tell if it be right? *Ans.* Your quotient or answer will be like the term which was made the first in doing the sum.

For example how state?

Why?

How perform?

And prove the following sums.

EXAMPLES.

If 20 yards of cloth cost 30 dollars, what cost 6 yards.

First term; because it cost the second.	Second term; because of the same kind as the answer.	Third term; because of the same kind, or like the first.
20yds. :	30dols. : :	6yds.
	6	

$$\begin{array}{r} 2,0)\overline{18,0} \\ \hline 9 \end{array}$$

9 dol. because the 2d is dollars.

Does more require more, or less require less in the above sum? *Ans.* Less requires less.

Repeat when less requires less, and more requires more.

How does less require less in the foregoing sum? *Ans.* The yards of cloth to be bought are *less* than what were bought; hence it is plain that it will take less money to buy a less number of yards of cloth, i. e. the less cloth the less money.

What is the proof of the above?

dols.		yds.		dols.
9	:	6	: :	30
		30		

9)180

20yds. being the first term, proves the work right.

In the proof, does more require more, or less require less? *Ans.* More requires more.

How does more require more? *Ans.* The more money the more yards.

Note.—The scholar should be required to read his statement, to see if it agree with the condition of the question.

What can you buy 15yds. of cloth for, if 10yds. cost 20 dollars? *Ans.* 30 dollars.

What can you buy 15 tons of hay for, if 3 tons cost ten dollars? *Ans.* 30 dols.

What will 20 lbs of sugar come to at 9d per pound? *Ans.* 15 shillings.

What is the meaning of 9d, or 6d, &c. per lb. per oz. &c.? *Ans.* One pound, or ounce, &c. cost 9d.

If 4 tons of hay will keep 2 cattle over the winter; how many tons will it take to keep 25 cattle, at the same rate? *Ans.* 50 tons.

If you give 50 dollars for one horse; what must you give for 10 horses at the same rate? *Ans.* 500 dols.

If you buy 1 knife for 6d, what must you give for 18 at the same rate? *Ans.* 3 shillings.

What will 20 bushels of rye come to at 25 cents per bushel? *Ans.*

INVERSE PROPORTION; OR RULE OF THREE INVERSE.

To what questions does the Rule of Three Inverse relate? *Ans.* Questions in which more requires less, or less requires more.

When does more require less? *Ans.* When the third term is *more* than the first, and requires the fourth term to be *less* than the second.

When does less require more? *Ans.* When the third term is *less* than the first, and requires the fourth to be *more* than the second.

How state the sums? *Ans.* As in the Rule of Three Direct.

Which terms multiply together? *Ans.* First and second.

What divide by? *Ans.* The third.

In what denomination will your answer come out? *Ans.* In the same that the middle term was brought into.

What is the proof? *Ans.* As in the Rule of Three Direct.

How state the following sums and why?

If 12 men can build a wall in 20 days, how many men can do the same in 8 days? *Ans.* 30 men.

In the above, does more require less, or less more? *Ans.* Less requires more.

How does less require more? *Ans.* The less days the more men.

If 48 men build a wall in 12 days in how many days will 120 men do the same? *Ans.* 4 days.

Does more require less or less require more? *Ans.* More requires less.

How is this? *Ans.* The more men, the less days.

If a man performs a journey in five days, when the day is 12 hours long, in how many days will he perform it, when the day is but 10 hours long, and does less require more or more less?

If 10 men build a ship, in 120 days, how many men will be necessary to do the same, in 30 days. *Ans.* 40 men.

Note.—As questions in practice may be easily solved by the Rule of Three, it being only a contraction of that rule when the first term happens to be a unit, or one; and as reckoning in Federal Money has rendered it almost useless, it will be omitted as has been by many writers. The instructor will of course direct the pupil to attend to the performance of this rule found in the Arithmetic which this may accompany if deemed proper.

TARE AND TRETT.

What are practical rules for deducting certain allowances made on goods, in buying and selling by weight called? *Ans.* Tare and Trett.

What is the whole weight of goods including external package called? *Ans.* Gross weight.

What is an allowance for the weight of the external package, called? *Ans.* Tare.

What is an allowance of one pound on every 26 for waste, dust &c., called? *Ans.* Trett.

What is an allowance of one pound, on every 168 to retailers, for the turn, of the scale, called? *Ans.* Cloff.

What is that which remains after a part of the allowance has been made, called? *Ans.* Suttle.

What is that which remains after all allowances are made, called? *Ans.* Neat Weight.

CASE, I.

When the question is an invoice, what is the rule? *Ans.* Subtract the whole tare from the gross.

What is that which remains called? *Ans.* The neat weight.

CASE, II.

When the tare is at so much per box, each &c., what is the rule? *Ans.* Subtract the whole tare from the gross.

What is the remainder called? *Ans.* Neat weight.

CASE, III

When the tare is at so much per cwt. what is the rule? *Ans.* Find the tare by the Rule of Three, or divide the gross weight by the aliquot parts of a cwt. and subtract the tare from the gross, the remainder is the neat weight.

CASE, IV.

When the trett is allowed with the tare, how find the tare? *Ans.* As before.

What divide the remainder or suttle by? *Ans.* 26.

What will the quotient be? *Ans.* Trett.

How proceed next? *Ans.* Subtract the trett from the the suttle.

What will the remainder be? *Ans.* The neat weight.

CASE, V.

When Tare, Trett, and Cloff are allowed, how deduct the tare and trett? *Ans.* As before.

What divide by? *Ans.* 168.

Why? *Ans.* Because 2 lbs is $\frac{1}{168}$ of 3 cwt.

What will the quotient be? *Ans.* Cloff.

How is the cloff to be subtracted? *Ans.* From the suttle.

What will the remainder be? *Ans.* Neat weight.

INTEREST.

What is the allowance, paid by the borrower, to the lender, for the use of money called? *Ans.* Interest.

How many kinds are there? *Ans.* Two.

What are they? Simple and Compound.

What is Simple Interest? *Ans.* That interest which is allowed for the principal only.

At what rate per cent, is it generally reckoned? *Ans* Six per cent per annum.

How is this per cent fixed in most of the United States? *Ans.* By law.

What is the meaning of 6 per cent per annum? *Ans.* Six dollars for the use of 100 dollars, or £6 for the use of £100 for one year, &c.

What is the meaning of per annum? *Ans.* For a year.

What is the interest, which is established by law called? *Ans.* Legal interest.

Suppose there is no rate per cent mentioned; what per cent is always to be understood? *Ans.* The rate per cent established by law.

What is that in our own state? *Ans.* 6 per cent.

How many things are to be noticed in interest? *Ans* Three.

What are they? *Ans.* Principal, Rate and Amount.

What is the Principal? *Ans.* The sum lent.

What is the Rate? *Ans.* The sum per cent agreed on.

What is the amount? *Ans.* The Principal and Interest added together.

How is the best way to find the interest of any sum, whether dollars, eagles, guineas, pounds, or shillings &c. at 6 cent, for 1 year or more? *Ans.* Multiply by ½ the number of months and divide by 100, or cut off two figures.

EXAMPLES.

Remark. The instructor will continue to bear in mind that the slate is not to be used by the scholar in giving the answers to the examples.

What is the interest of 40 dollars for one year? *Ans.* 2 dols. 40 cents.

What is the interest of 50 dols. for 12 months? *Ans.* 3 dols.

What is the amount? *Ans.* 53 dols.

What is the interest of 80 dols. for 10 months? *Ans.* 4 dollars.

What is the amount? *Ans.* 84 dollars.

What is the interest of 8 dols. for 4 months? *Ans.* 16 cents.

What is the amount? *Ans.* 8 dollars 16 cents.

What is the interest of 4 dols. for 4 months? *Ans.* 8 cents.

What is the amount? *Ans.* 2 dols. 8 cents.

What is the interest of 2 dols. for 4 months? *Ans.* 2 cents.

What is the interest of 20 dols. for 2 months? *Ans.* 20 cents.

What is the amount? *Ans.* 20 dols, 20 cents.

What is the interest of 8 dols. for 1 month? *Ans.* 4 cents.

What is the amount? *Ans.* 8 dols. 4 cents.

What is the interest of 80 dols. for 1 month? *Ans.* 40 cents.

What is the amount? *Ans.* 80 dols. 40 cents.

What is the interest of 800 dols. for one month? *Ans.* 4 dols.

What is the amount? *Ans.* 804 dols.

What is the interest of 8000 dols. for 1 month? *Ans.* 40 dols.

What is the amount? *Ans.* 8040 dols.

What is the interest of 5 dols. for 12 months? *Ans.* 30 cents.

What is the amount? *Ans.* 5 dols. 30 cents.

What is the interest of 50 dols. for one year? *Ans.* 3 dols.

What is the amount? *Ans.* 53 dols.

What is the interest of 500 dollars for one year? *Ans.* 30 dols.

What is the amount? *Ans.* 5030 dols.

What is the interest of 5000 dols. for one year? *Ans.* 800 dols.

What is the amount? *Ans.* 5300 dols.

What is the interest of 1 dollar for 4 years? *Ans.* 24 cents.

What is the amount? *Ans.* 1 dol. 24 cents.

What is the interest of 1 dol. for 12 years? *Ans.* 60 cents.

What is the amount? *Ans.* 1 dol. 60 cents.

What is the interest of 50 dols. for 2 years and 6 months? *Ans.* 7 dols. 50 cents.

What is the amount? *Ans.* 57 dols. 50 cents.

What is the interest of £100 for 8 months? *Ans.* £4.

What is the amount? *Ans.* £104.

What is the interest of £10 for 1 year and 8 months? *Ans.* £2.

What is the amount? *Ans.* £12.

What is the interest of 2 dols. 50 cents for 2 months? *Ans.* 2 cents 5 mill.

What is the amount? *Ans.* 2 dols. 52 cents. 5 mills.

What is the interest of 6 dols. 50 cents, for 2 months? 6½ cents.

Remark.—As a difficulty arises in directing the scholar to multiply by ½ the number of months when the sum consists of years, months, and days, together, the following table is composed, by putting 30 under the given number of days,—reducing the fraction to its lowest terms, and a rule subjoined, by which the interest for any number of days may be found readily with fewer figures than any other way.

What part of a month is 1 day? *Ans.* $\frac{1}{30}$.

What part are 2 days? *Ans.* $\frac{1}{15}$.

What part are 3 days? *Ans.* $\frac{1}{10}$.

What part are 4 days? *Ans.* $\frac{2}{15}$.
What part are 5 days? *Ans.* $\frac{1}{6}$.
What part are 6 days? *Ans.* $\frac{1}{5}$.
What part are 7 days? *Ans.* $\frac{7}{30}$.
What part are 8 days? *Ans.* $\frac{4}{15}$.
What part are 9 days? *Ans.* $\frac{3}{10}$.
What part are 10 days? *Ans.* $\frac{1}{3}$.

Remark.—The parts of a month for any number of days from 10 to 30 or more, may be found by the table above; as 5 are $\frac{1}{6}$, then 25 are 5 times as many, i. e. $\frac{5}{6}$, or by putting 30 under the given days for a denominator, and for the sake of convenience in multiplying reducing the fraction to its lowest terms.

For example: what part of a month are 20 days? *Ans.* 10 are $\frac{20}{30}=\frac{2}{3}$.

As preparatory to the following rule how do you get $\frac{1}{2}$, of a fraction? *Ans.* Double the denominator.

How much is $\frac{1}{2}$ of $\frac{15}{30}$? *Ans.* $\frac{15}{60}$.

How prove this? *Ans.* $\frac{15}{30}$ is equal to $\frac{1}{2}$ and $\frac{15}{60}$ to $\frac{1}{4}$ and $\frac{1}{2}$ of $\frac{1}{2}$ is a quarter; then $\frac{1}{2}$ of $\frac{15}{30}$ is $\frac{15}{60}$.

How much is $\frac{1}{2}$ of $\frac{100}{200}$? *Ans.* $\frac{100}{400}$.

How much is $\frac{1}{2}$ of $\frac{7}{8}$? *Ans.* $\frac{7}{16}$.

How much is $\frac{1}{2}$ of $\frac{7}{16}$? *Ans.* $\frac{7}{32}$.

In multiplying by half the number of months when the sum consists of days, what is the rule? *Ans.* Double the denominator and multiply and cut off as before.

EXAMPLES.

What is the interest of 60 dols. for 5 days? 5 are $\frac{1}{6}$ of a month.

12)60

—

Ans. 5 cents.

Where did you get your 12? *Ans.* Double of 6, the denominator.

What is the interest of 40 dollars for ten days.
Ans. 10 are $\frac{1}{3}$ 6)40

—

6, $\frac{4}{6}$ cents.

What is the interest of 12 dollars for 20 days?
Ans. 20 are $\frac{2}{3}$. 12
2

—

6)24

—

Ans. 4 cents.

Note.—The scholar will recollect his rule, that to multiply by a fraction, division is necessary, and when the numerator is 19 division alone is necessary.

The longest of the remaining sums in this rule may be performed on the slate at recitation.

What is the interest of 120 dols. for 8 years, 4 months, and 15 days.

120
50$\frac{1}{4}$ half the number of months.

—

6000
30

—

Ans. $60, 30 Where did you get the $\frac{1}{4}$? *Ans,* 15 are $\frac{1}{2}$; $\frac{1}{2}$ of $\frac{1}{2}$ is $\frac{1}{4}$.

What is the interest of 60 dols. for 16 years 8 months and 10 days.

6)60,00 annexing 2 cyphers for
10 multiplying by $\frac{1}{2}$ the number of months.

—

Ans. $60,10

The ten is thus placed because 60 only is to be multiplied by $\frac{1}{6}$.

What is the interest of 12 dollars for 41 years 8 months and 25 days?

12	12	
5	$250\frac{5}{12}$	25 are $\frac{25}{30}=\frac{5}{6}$ double of 6 makes 12 i. e. $\frac{5}{12}$.
12)60	600	
	24	
5	5	
	Ans. 30,05	

What is the interest of 100 dollars for 15 days? *Ans.* 25 cents.

What is the interest of 24 dollars for $\frac{1}{3}$ of a month? *Ans.* 4 cents.

To give as difficult a sum perhaps, as any, to show the conciseness of the rule; what is the interest of 1200 dols. for 12 years, 11 months and 29 days?

1200	1200
29	$77\frac{1}{2}$
10800	8400
2400	8400
	600
6,0)3480,0	580
580	$ 935,80 with $\frac{1}{3}$ the usual number of figures.

To cast the interest when the rate is not 6 what do first? *Ans.* Find the interest as before, for 6 per cent.

What do then? *Ans.* Multiply by the given rate and divide by 6.

EXAMPLES.

What is the interest of 120 dollars for 15 years, 11 months and 25 days at 9 per cent.

Old Method.

		120
		9
6 months is	½	1080
		15
		5400
		1080
		16200
3 months is	½	540
		270
1 month is	⅓	90
1 month is	do	90
10 days	⅓	30
10 days	do	30
5 days	½	15

172,65 *Ans.* With 63 figures.

New Method.

120	120
95½ half the number of months,	5
600	12)600
1080	50
60	
50 for 25 days.	

115,10 for 6 per cent, and about ⅓ as many figures as in the usual mode of this per cent.

9

6)103,590

$172,65 *Ans.* with 47 figures.

There being a saving of 16 figures by the new method, and not so difficult to be understood, and practised by the scholar, as by the old way of taking parts.

Note.—When no months or days enter into the calculation, the old method of multiplying by the rate and then by the years is evidently preferable for the adept, but experience has proved, that one uniform way is better than to perplex the novice with two rules totally different in their operations, when one in all cases will solve his questions.

What is the interest of 30 dols. for 2 days at 3 per cent? *Ans.* $\frac{1}{30}$)30

,01
3

6)03

,005 mill.

What the interest of 12 dols. for 10 days at $\frac{1}{3}$ per cent?

What is the interest of 60 dols. for 5 days at 4 per cent?

What is the interest of 40 dols. for 3 days at 12 per cent?

What is the interest of 40 dols. for 3 days at $12\frac{3}{4}$ per cent?

What is the interest of £100 for one year 8 months and 9 days, at 8 per cent?

100
$10\frac{3}{20}$ 5 are $\frac{4}{30}=\frac{3}{10}$.

1000
15 for 9 days.

10,15 for 6 per cent.
8

6)8120

13,53
20

10,60
12

720 *Ans.* £13 10s. 7d.

On what principle do you multiply by the given rate, and divide by 6? *Ans.* On the principal of the Rule of Three.

What would be the statement? *Ans.* If 6 per cent, draw so much interest, what will the given rate draw.

Why multiply by $\frac{1}{2}$ the number of months? *Ans.* Because a dollar drawshalf a cent a month.

COMMISSION.

What is an allowance made to persons, in buying and selling goods for others called? *Ans.* Commission.

How are questions in this rule, Brokerage and Insurance answered? *Ans.* By Interest.

What do you demand for selling 400 dollars worth of Cotton, at $2\frac{1}{2}$ per cent commission? *Ans.* \$10.

What is your demand for selling 300 pounds of

Indigo, at 1 dollar per pound, for 5 per cent. commission? *Ans.* 15 dollars.

When you give a man so much per cent. for changing money, or assisting you in purchasing stock, in banks, &c. what is it called? *Ans.* Brokerage.

What would a broker demand for changing 50 dollars, at 1 per cent? *Ans.* 50 Cents.

J. B. W. offers to give Providence bills for Connecticut, for ¼ per cent. how much must you pay him for changing 1000 dollars? *Ans.* 2 dols. 50 cents.

What is the making good the losses, which may happen from storms, fire, &c. called? *Ans.* Insurance.

What is the insurance on an East-India ship and cargo, valued at 10,000 dollars, at 10 per cent? *Ans.* 1000 dollars.

When interest is required on bills, notes, &c. with indorsements, what is the rule? *Ans.* Subtract the amount of indorsements from the amount of principal, reckoning the interest on each from date to settlement.

COMPOUND INTEREST.

When you add the interest to the principal at the end of one year, and find the interest of this amount for the second, and so on, what is it called? *Ans.* Compound Interest.

What is Compound Interest in other words? *Ans.* Interest on Interest.

What is the rule? *Ans.* Find the amount of the principal at the end of one year, then find the interest of this amount for the second and so on.

How long continue to do so? *Ans.* As many times as there are years.

What will the last amount be? *Ans.* The answer.

How find the Compound Interest? *Ans.* Subtract the given sum or principal from the last amount.

Which is the most, Simple or Compound Interest? *Ans.* Compound,

How is this? *Ans.* Simple, is the interest for the principal only, Compound,is the interest for the principal and the interest of each year besides.

How long does it take a sum to double at Compound Interest? *Ans.* About 12 years.

How long does it take a sum at Simple Interest to double? *Ans.* About 17 years

When you borrow money of James, and give him your note on interest, and some time after you give him a new note, and pay the interest or add it to the principal, what is it called? *Ans*, Renewing the note.

When notes are renewed annually, and the interest added to the principal, what kind of interest is it? *Ans.* Compound.

DISCOUNT.

What rule tells you what you ought to pay, when a sum is due at some future day, if you pay it down? *Ans.* Discount.

What would that sum which you ought to pay,be? *Ans.* Such a sum as if put at interest would amount to it.

What may this sum be called? *Ans.* Present worth.

What make the first term in stating? *Ans.* The amount of 100 for the given rate and time.

What make the middle term? *Ans.* 100.

What the third term? *Ans.* The given sum.

What do to find the discount? *Ans.* Subtract the present worth from the given sum; the difference is the answer.

How state this sum? You owe 500 dollars, due one year from the present time, to find how much you ought to pay to take up your note now?

EQUATION OF PAYMENTS.

What is the process of finding, when a debt is payable at different times, how it may be paid without disadvantage to either party, called? *Ans.* Equation of Payments.

How multiply? *Ans.* Each payment by its time.

What divide the sum of the products by? *Ans.*By the whole debt.

What is the quotient? *Ans.* The equated time for paying the whole.

BARTER.

What is the exchanging one sort of goods for another called? *Ans.* Barter.

How are questions in this rule answered? *Ans.* By the Rule of Three.

You sell 20 knives for 4 cents a piece, to Harry, and agree to take what the knives come to in marbles at 2 cents a piece; how many marbles do you get?

You borrow 20 new marbles of John, worth six cents a piece, and lose them; how many of your old ones, which are worth no more than 4 cents a piece, ought you to give John?

LOSS AND GAIN.

What is the rule which enables merchants to estimate their profit or loss, in selling goods. and to raise or lower the prtce, so as to gain or lose so much per cent? *Ans.* Loss and Gain.

How are questions in this rule answered? *Ans.* By the Rule of Three.

To find what is lost or gained per cent. How ascertain the gain or loss? *Ans.* By Subtraction.

Then what make the first term in stating *Ans.*The cost.

What make the middle term? *Ans.* The gain or loss.

What the third term? *Ans.* 100.

To find how goods may be sold, to lose or gain so much per cent.

RULE.

What make the first term? *Ans.* 100 pounds, or dollars.

What make the middle term? *Ans.* The cost.

What make the third term? *Ans.* 100 dollars or 100 pounds, with the profit added, or loss subtracted

What will the answer be? *Ans.* The price of sale.

FELLOWSHIP.

What is the rule to settle the account of people who have been trading in company, called? *Ans.* Fellowship.

When the several shares are continued in trade, an equal length of time, what is it called? *Ans.* Single Fellowship.

When the shares of stock are continued in trade an unequal length of time, what is it called? *Ans.* Double Fellowship.

RULE.

What make the first term? *Ans.* The whole stock.

What the middle term? *Ans.* The whole gain or loss.

What the third term? *Ans.* Each man's stock.

What will the answer be? *Ans.* Each man's gain or loss

By what rule is a bankrupt's estate divided among his creditors? *Ans.* Single Fellowship.

DOUBLE FELLOWSHIP.

RULE.

What is the first thing to be done? *Ans.* Multiply each man's stock by the time it was in trade.

What make the first term in stating? *Ans.* The sum of the several products.

What make the middle term? *Ans*. The whole gain or loss.

What make the third term? *Ans*. Each man's particular product.

What will the answer be? *Ans*. Each man's particular gain or loss.

DOUBLE RULE OF THREE.

What rule teacheth to resolve such questions as require two or more statings in simple proportion, whether direct or inverse, called? *Ans*. Double Rule of Three.

How many terms are there always given? *Ans*. 5.

For what purpose are they given? *Ans*. To find a sixth.

What are the three first terms? *Ans*. Supposition.

What are the two last? *Ans*. Demand.

In stating the question; what of the supposition make the first term? *Ans*. The principal cause of gain, loss, &c.

What of the supposition make the second term? *Ans*. The time, distance of place, &c.

What in the third place? *Ans*. The remaining term of the supposition.

Where are the terms of the demand to be placed? *Ans*. Under those of the same kind in the supposition.

If the blank place or term sought, fall under the third term, what is the proportion? *Ans*. Direct.

Which terms multiply together for a divisor? *Ans*. 1st and 2d.

Which for a dividend? *Ans*. The other three.

But if the blank place or term sought, fall under the first or second term, what is the proportion? *Ans*. Inverse.

Which terms multiply together for a divisor? *Ans*. 3d and 4th.

Which for a dividend? *Ans*. The other three.

What will the quotient be? *Ans.* The answer.

For Example.—If a man can build 36 rods of wall in 2 days, how many rods can 26 men build in 10 days—how state this sum, and why?

VULGAR FRACTIONS

MORE PARTICULARLY.

How many parts are vulgar fractions divided into? *Ans.* 4.

What are they? *Ans.* Proper, improper, compound, and mixed.

What is a proper fraction? *Ans.* When the numerator is less than the denominator.—Give an example? *Ans.* $\frac{1}{2}$ or $\frac{5}{6}$.

What is an improper fraction? *Ans.* When the numerator is more than the denominator.—Give an example? *Ans.* $\frac{2}{1}$ or $\frac{6}{5}$.

What is a compound fraction? *Ans.* The fraction of a fraction.

What is it coupled by? *Ans.* Of.

Give an example? *Ans.* $\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{3}{4}$ of $\frac{4}{5}$ of $\frac{5}{6}$.

What is a mixed number? *Ans.* It is composed of a whole number and a fraction.

Give an example? *Ans.* $15\frac{3}{8}$.

How can any whole number be converted into a fraction? *Ans.* By putting 1 under it.

Give an example? *Ans.* 6 makes, converted into a fraction, $\frac{6}{1}$.

What is the value of a fraction? *Ans.* The quotient of the numerator divided by the denominator.

What is the value of $\frac{6}{1}$ then? *Ans.* 6 for 1 goes in 6, 6 times.

When a building is divided into 20 parts and you own 8; how would you express your part in fractions. *Ans.* $\frac{8}{20}$.

What part must another man have to own the rest of the building? *Ans.* $\frac{12}{20}$.

How prove this? *Ans.* 8 and 12 are 20, just the number of parts the building was divided into.

You have said the value of a fraction was the quotient of the numerator divided by the denominator, then tell me the value of $\frac{8}{4}$. *Ans.* 2.

How prove this? *Ans.* If 12 apples is divided into 4 parts each, or quarters, 8 must mean 8 quarters, and 8 quarters make 2 whole apples.

What is the value of $\frac{20}{5}$? *Ans.* 5.

What is the value of $\frac{9}{8}$? *Ans.* 1$\frac{1}{8}$.

What is the common measure of two or more numbers? *Ans.* That number that will divide them without a remainder.

What is the common measure of 12, 24, and 30? *Ans.* 3.

Why? *Ans.* Because it will divide each of them without a remainder.

What is the greatest number that will do this called? *Ans.* The greatest common measure.

What is a number that can be measured by two or more numbers called? *Ans.* Their common multiple.

If it be the least number that can be so measured what is it called? *Ans.* Their least common multiple.

What is the common multiple of 2, 3, and 4? *Ans.* 24.

Why? *Ans.* Because 24 can be divided by 2, 3 and 4, without a remainder.

What is the last common multiple of these numbers? *Ans.* 12.

Note. The rule for reducing a fraction to its lowest term has been given previously.

How do you reduce a mixed number to an improper fraction? *Ans.* Multiply the whole number by the denominator and add in the numerator, under this sum write the denominator.

Does this alter its value? *Ans.* It does not.

Why? I have said that the value of a fraction was the quotient arising from dividing the numerator by the denominator, and this operation would bring it back again to the same fraction.

For Example--Reduce $4\frac{1}{2}$ to an improper fraction? *Ans.* $\frac{9}{2}$.

What is the value of this? *Ans.* 2)9

—

$4\frac{1}{2}$.

Hence to find the value of an improper fraction is already done in the above operation.

Give an example of an improper fraction reduced to find its value? *Ans.* $\frac{10}{6}$ 5)10

—

2 *Ans.*

How reduce a whole number to a fraction with a given denominator? *Ans.* Multiply the whole number by the denominator, and put the denominator under the product.

For Example--Reduce 5 to a fraction, whose denominator shall be 6. *Ans.* $\frac{30}{6}$.

Is the value altered? *Ans.* It is not.

How is the value not altered? *Ans.* According to the definition of the value of a fraction above, it is not, for 6 in 30, 5 times, the whole number.

What is the meaning of changing a whole number into a fraction with a given denominator? *Ans.* It means that 8 (or whatever the whole number is) whole apples are to be divided each into as many parts, as the given denominator says.

For Example—Suppose I should tell you to divide 8 apples each into 4 parts or quarters, how many parts would all the apples make? *Ans.* 32, i. e. 8

the whole number, multiplied by the given denominator 4 (which always shows how many parts 1 whole thing is divided into.)

What would be the fractional expression? *Ans.* $\frac{32}{4}$.

What does the 4 show?

What is the value of this? *Ans.* 8.

How reduce whole and mixed numbers in changing compound fractions to simple or to proper fractions of equal value? *Ans.* To improper fractions.

What do then? *Ans.* Multiply the numerator and denominator together.

How does the reduction by the rule not affect the value? *Ans.* $\frac{1}{2}$ of $\frac{1}{2}$ is $\frac{1}{4}$ always, whether of an apple or anything else, i. e. 2 times 2, and so with any other numbers.

For Example—Reduce $\frac{1}{2}$ of $\frac{1}{3}$ of $\frac{1}{4}$ to a simple fraction? *Ans.* $\frac{1}{24}$.

Reduce $\frac{1}{5}$ of $\frac{1}{10}$? *Ans.* $\frac{1}{50}$.

How reduce fractions of different denominators to a common denominator? *Ans.* Multiply each numerator by all the denominators but the one under it, for a new numerator—and all the denominators together for a new denominator.

What do you mean by a common denominator? *Ans.* When the denominators are all alike.

Is the value altered in this reduction? *Ans.* It is not.

How is the value not altered? *Ans.* It has been shown heretofore that multiplying the numerator and denominator by the same number does not alter the value, and in this rule they are so multiplied.

Give an example of $\frac{1}{2}$ and $\frac{3}{4}$ reduced to a common denominator? *Ans.* $\frac{4}{8}$, $\frac{6}{8}$.

What was 1 multiplied by? *Ans.* 4, as 4 times 1 is 4.

What was its denominator multiplied by? *Ans.* 4, as 4 times 2 is 8.

ADDITION OF VULGAR FRACTIONS.

What is the rule? *Ans.* Reduce the fractions to a common denominator, then write the sum of the numerators over the denominator.

SUBTRACTION OF VULGAR FRACTIONS.

What is the rule? *Ans.* Reduce the fractions as in Addition, than write the difference of the numerators over the common denominator.

MULTIPLICATION OF FRACTIONS.

What is the rule? *Ans.* Reduce all the fractions to single or improper ones, then multiply all the numerators together for a new numerator and all the denominators together for a new denominator.

For Example—Multiply $\frac{1}{2}$ by $\frac{3}{4}$? *Ans.* $\frac{3}{8}$.
Multiply $\frac{3}{8}$ by $\frac{2}{8}$? *Ans.* $\frac{6}{64}$.
Multiply $\frac{4}{5}$ by $\frac{3}{5}$? *Ans.* $\frac{12}{25}$.

DIVISION OF FRACTIONS.

What is the rule? *Ans.* Invert the divisor, and proceed exactly as in multiplication.

For Example--Divide $\frac{4}{8}$ by $\frac{2}{8}$? *Ans.* $\frac{32}{16}$.

How prove this? *Ans.* $\frac{2}{8}$ is in $\frac{4}{8}$, or 2 in 4: 2, now $\frac{32}{16}$ is equal to 2, for the value of a fraction is &c.

Examples to exercise the scholar in Fractions

You own $\frac{1}{8}$, B $\frac{2}{8}$, C $\frac{4}{8}$ and D the rest of a vessel; D's part was 100 dollars; how much was each man's part, and what part did D own? *Ans.* The vessel is divided into 8 parts, all the parts except D's make 7: consequently D's part is $\frac{1}{8}$, and if $\frac{1}{8}$ is 100 dollars, $\frac{2}{8}$ is 200 and so on. I own 100 dollars, B 200, C 400, and D $\frac{1}{7}$.

There is a beam, $\frac{5}{16}$ is in the ground, $\frac{9}{16}$ in the water, and the rest being 2 feet out of water, how long is the beam? *Ans.* 16 feet.

How did you do it? *Ans.* 9 and 5 are 14, there remain 2 parts which are 2 feet, i. e. 1 foot for 1 part, and for 16 parts 16 feet.

You give 5 dollars for $\frac{1}{5}$ of a sled, how much must you give for the other part, and how much is the sled worth?

There are 8 nine-pences in a dollar, now you have $\frac{9}{8}$ of a dollar, how much money have you? *Ans.* $1\frac{1}{8}$ dollar.

In the school which you attend, $\frac{1}{5}$ are studying Latin, $\frac{2}{5}$ Greek, $\frac{1}{5}$ Grammar, and the rest, being 10 in number have just commenced Practical and Mental Arithmetic; how many scholars compose the school? *Ans.* $\frac{1}{5}+\frac{2}{5}+\frac{1}{5}=\frac{4}{5}$; then 10 are $\frac{1}{5}$; and if 10 are $\frac{1}{5}$, $\frac{5}{5}$ is 50 scholars, the answer.

Note.—When the denominators are not alike, they may be reduced to a common denominator, and then they will be very simple.

How can fractions, as a convenient practical method, be reduced to their least common denominator? *Ans.* Multiply or divide any or each fraction by any number that will make the denominators alike.

How does this not affect the value? *Ans.* It has been proved that multiplying, or dividing both numerator and denominator, by the same number, does not alter the value.

Reduce $\frac{2}{8}$ and $\frac{3}{4}$ to their least common denominator? *Ans.* Dividing $\frac{2}{8}$ by 2 reduces it: as $\frac{1}{4}$ $\frac{3}{4}$.

EXAMPLES.

Suppose there is a mast erected, so that $\frac{1}{8}$ of its length stands in the ground, 12 feet of it in the water, and $\frac{5}{8}$ of its length in the air, or above water; I demand the whole length?

$2\times\frac{1}{8}$ $\frac{5}{6}\times3$

$\frac{2}{18}+\frac{15}{18}=\frac{17}{18}$ Now $\frac{1}{18}$ more makes the whole, and as $\frac{1}{18}$ is 12 feet, then the whole is 12 times 18=216 *Ans.*

In an orchard of fruit trees, ½ of them bear apples, ¼ peaches, $\frac{1}{6}$ plums, 40 of them pears, and ten cherries; how many trees does the orchard contain?

$6\times\frac{1}{2}$ $3\times\frac{1}{4}$ $2\times\frac{1}{6}$

$\frac{6}{12}\times\frac{3}{12}\times\frac{2}{12}=\frac{11}{12}$ then 40 peaches and 10 cherries are $\frac{1}{12}$, and if 50 are $\frac{1}{12}$, then $\frac{12}{12}$, or the whole is 12 times 50=600, *Ans.*

A gentleman left his son a fortune, ¼ of which he spent in 3 months; $\frac{3}{7}$ of the remainder lasted him 10 months longer, when he had only 2524 dollars left; pray what did his father bequeath him?

$$\begin{array}{r} 3 : 2524 : 7 \\ 7 \\ \hline 3)17668 \\ \hline \end{array}$$

Ans. 5389,33⅓ the value of seven parts, or the whole.

The third part of an army was killed, the fourth part taken prisoners, and 1000 fled; how many were in this army, how many killed, and how many captives?

⅓ ¼

$\frac{4}{12}+\frac{3}{12}=\frac{7}{12}$ now, as $\frac{5}{12}$ more make the whole, or $\frac{12}{12}$, it is evident that $\frac{5}{12}$ must be 1000, and if 5 parts be 1000, what will 12 parts, or the whole be? As 5 : 1000 : 12

$$\begin{array}{r} 12 \\ \hline 5)120,000 \end{array}$$

Carried over.

5)120,000

$\frac{1}{4}$ | $\frac{1}{3}$)2400 in the army.

800 killed.
600 taken prisoners.

James gave to John 6 dollars, which was $\frac{2}{3}$ of all the money he had ; how much had he?

You sell a watch for 18 dollars, which was $\frac{4}{3}$ of what it cost you ; how much do you make by the bargain? *Ans.* 4$\frac{1}{2}$ dollars.

How much did he give for it? *Ans.* 13$\frac{1}{2}$ dollars.

How much are 3 thirds? *Ans.* The whole.

How much are 4 thirds? *Ans* 1 and $\frac{1}{3}$.

In the above sum, what would 3 thirds of what it cost him be? *Ans.* As $\frac{3}{3}$ is a whole, to sell it for $\frac{3}{3}$ of what it cost him, is to sell it for what it cost.

What does 4 thirds of what it cost mean? *Ans.* $\frac{1}{3}$ more than cost.

In the above sum, $\frac{1}{3}$ is $\frac{1}{4}$ of 18=4$\frac{1}{2}$ now, how much are 4 thirds? *Ans.* 4 times 4$\frac{1}{2}$, i. e. 18.

How much more than the whole is $\frac{10}{3}$ of 18? *Ans.* 42.

If he had sold his watch for 30 dollars, which was $\frac{5}{3}$ of what it cost him, how much would he have made? *Ans.* 12 dollars.

How prove this? *Ans.* $\frac{1}{3}$ must be 6, i. e. 30 divided by 5, if $\frac{5}{3}$ is 30 ; and as $\frac{3}{3}$ is a whole, $\frac{3}{3}$ is equal to 3 times 6=18—of course he gained 12 dollars, or $\frac{2}{3}$, which is equal to 12 dollars.

A man sold a horse for 4 fifths of what it cost him ; did he gain or lose, and how much?

A man sold a horse for 20 dollars, which was 10 fifths of what it cost him ; did he make or lose, and how much?

You give away 2 dollars, which is $\frac{2}{16}$ of all the money you have ; how much money have you?

If $\frac{1}{8}$ of a yard of cloth is worth 2 dollars, how much is a whole yard worth,

How much is $\frac{8}{8}$ worth?

How much is $\frac{12}{8}$ worth?

How much is $\frac{16}{8}$ worth?

How much is $\frac{24}{8}$ worth?

You buy a cow for 20 dollars, and sell her for $\frac{6}{5}$ of what she cost you; do you make or lose, and how much?

A man wishing to purchase a horse, refused to give 24 dollars, the price asked; but to make a little display of his knowledge of fractions, said he would give $\frac{8}{6}$ of 24 dollars, on hearing of which the seller immediately told him it was a bargain; now which knew the most about fractions, the buyer or seller, and how much does the purchase price differ from what was asked?

John says that he had as lief have $\frac{6}{3}$ of 20 apples, as to have 40 apples; does John know much about fractions?

How do you know that?

How much is $\frac{1}{2}$ of $\frac{1}{3}$?

How much is $\frac{1}{2}$ of $\frac{1}{8}$?

John says again that he had as lief have $\frac{1}{3}$ and $\frac{1}{2}$ of $\frac{1}{3}$ of 12 oranges, as to have 5; how near right is he now?

How much is $\frac{1}{3}$ and $\frac{1}{2}$ of $\frac{1}{3}$? *Ans.* $\frac{1}{2}$.

How prove this? *Ans.* $\frac{1}{2}$ of $\frac{1}{3}$ is $\frac{1}{6}$, and $\frac{1}{3}$ multiplied by 2 is $\frac{2}{6}$, and $\frac{1}{6}$ makes $\frac{3}{6}=\frac{1}{2}$.

INVOLUTION.

What is the continual multiplication of any number into itself, called? *Ans.* Involution.

What are the several products called? *Ans.* Powers.

What is the number denoting the height of the power called? *Ans.* Index, or exponent.

What is the second power called? *Ans.* A square.

What is the index or exponent? *Ans.* 2.

What is the third power called? *Ans.* A cube.

What is the index? *Ans.* 3.

What is the fourth power called? *Ans.* A biquadrate.

What is the fifth power called? *Ans.* A sursolid.

What is a factor? *Ans.* Either the multiplicand multiplier or both.

How many times do you multiply any number into itself? *Ans.* Till it is taken as a factor as many times as there are units in the index of the required power.

What is the square of 4? *Ans.* 16.

What is the exponent? *Ans.* 2.

How many times was 4 used as a factor? *Ans.* As many times as there are units in the exponent or index.

How many units are there?

What is the square of 12?

What is the cube of 2? *Ans.* 8.

What is the index?

What is the biquadrate, or fourth power of 2? *Ans.* 16.

What is the sursolid or fifth power of 2? *Ans.* 32,

What is the index?

Why is Land or Square Measure so called? *Ans.* Because each denomination is a square, or 2d power.

Give an example? *Ans.* 144 is the square of 12 inches.

What is 30¼ square yards the second power of? *Ans.* 5½.

Why is Solid or Cubic Measure so called? *Ans.* Because the several denominations are powers, or cubes.

Give an example—*Ans.* 1728 is the third power or cube of 12 inches.

A father gave his son a piece of land 30 rods long and 15 rods wide; but told him if he would tell how many rods would make a square, one side of which was to be the length of what he had already given him, he should have the lot, what must his answer be? *Ans.* 900 rods,

A man bought a square piece of land for a building spot, and by measurement one side was found to be 20 feet in length; how many rods did it contain? *Ans.* 400 feet.

A piece of land is 60 rods square, how many rods does it contain? *Ans.* 3600.

A Captain has in each rank and file 20 men, how many are there in the company.

In your instructor's school-room, which is exactly square, 10 pupils may be accommodated on each side; how many may be accommodated in the room.

What are the solid contents of a pile of wood 6 feet in length, breadth and depth? *Ans.* 216 feet.

What is the power to which 6 feet was raised, called? *Ans.* A cube.

A boy, having purchased ten marbles, was told, that if he would tell how many it would take to fill a square box, so wide that ten marbles would lie in a row in the bottom, he should have the box filled with marbles; the boy got them, now, let us see if you would have gotten them by your answer, and how many did he get over and above what he had purchased for his mathematical knowledge.

A farmer says to his son, our potatoes this year are all of a size, now (as you have cyphered considerably) if you will tell me how many bushels, allowing 200 to the bushel, our little square bin will hold, as you see that 20 lie along on the bottom in a straight line, you may go a fishing one half a day through the summer; the boy gave a correct answer, now I demand how many the bin held, and how many days the boy had to himself.

John found a square piece of gold, which measured on each side 2 inches; and was offered 60 dollars for every solid inch it contained, how much was the lump worth at that rate?

EVOLUTION.

Remark—As the design of this work is to embrace merely that portion of arithmetic, which is indispensible to the ordinary transactions of business; therefore the common rules, for the extraction of roots will be omitted. A few examples only will be given, sufficient to initiate the pupil into the principles of their operations.

By taking on trial a number, which is supposed will nearly make the given number, when multiplied into itself continually; most sums which are of a practical cast may be generally answered in this way by one or two operations.

What is Evolution? *Ans.* The opposite of Involution.

Define it more particularly? *Ans.* It is finding what number multiplied into itself continually, as in Involution, will make the given sum or power.

What is the number so found, called? *Ans.* The root.

What are roots which cannot be perfectly evolved without leaving indefinite fractions, called? *Ans. Irrational*, or surd roots.

What are those which can? *Ans. Rational* roots.

What is a root? *Ans.* It is that number which by a continual multiplication into itself produces the given power.

What is Evolution then? *Ans.* It is finding a root.

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What is Involution? *Ans.* It is finding a power, or a power of a root.

EXTRACTION OF THE SQUARE ROOT.

What does any number multiplied into itself produce? *Ans.* A square.*

What is it then to extract the square root? *Ans.* It is only to find what number, multiplied into itself will make the given number.

What is the square root of 64? *Ans.* 8.

Why? *Ans.* Because 8 times 8 are 64.

What is the proof of the square root then? *Ans.* Multiply the answer or root into itself.

What must the result be like? *Ans.* The given sum.

What is the square root of 144, and the proof?

What is the square root of 400 and the proof?

What is the square root of 100 and the proof?

A man desirous of making his kitchen garden, which is to contain 2½ acres, or 400 rods, a complete square; what will be the length of the side?

A square lot of land is to contain 22½ acres, or 3600 rods of ground, but for the sake of fruit, there is to be a smaller square within the larger, which is to contain 225 rods; what is the length of each square? *Ans.* 60 rods the outer, 15 rods the inner.

One hundred scholars are to be placed in a square room, how many will that be on each side?

Suppose 40 boys should collect together to perform some military evolutions, and should wish to march through the town in a solid phalanx, or square body, how many would the first rank consist of?

A General has 400 men, how many must he place in rank and file, to form them into a square?

A certain square pavement contains 1600 square stones, all of the same size; I demand how many are contained in one of its sides? *Ans.* 40.

EXTRACTION OF THE CUBE ROOT.

What is the third power of any number called? *Ans.* A cube.

What is it to extract the cube root? *Ans.* It is only to find what number used as a factor three times will make the given sum or power; or it is that number which multiplied into its square, will produce the given number.

What is the proof then? *Ans.* Multiply the answer or root into itself till it is taken as a factor 3 times.

What is the cube root of 8? *Ans.* 2.

Why, or proof? *Ans.* Because 2×2×2=is equal to 8.

What is the cube root of 27? *Ans.* 3.

Why? *Ans.* Because 3×3×3=27.

What is the cube root of 64? *Ans.* 4.

What is the proof?

What is the cube root of 1000? *Ans.* 10.

Why; or proof.

What is the cube root of 8000? *Ans.* 20.

What is the proof? *Ans.* 20×20×20=8000.

The solid contents of a square pile of wood are 216 feet; I demand the length and breadth of said pile? *Ans.* 6 feet.

What is the proof?

In Involution you recollect that a boy got by his knowledge of powers a square box filled with marbles, containing 1000; now how many will reach across the bottom in a straight row, and how many reach from the top to the bottom in a straight line.

You recollect also the sum in Involution about potatoes, the size, the bin, &c.—the bin held 40 bushels; now how many will reach from one side of the bottom to the other in a right line—or straight row.

In Involution John found a piece of gold which brought 80 dollars, that is 10 dollars for each solid inch; what may be the shape of the piece, and the length of each side.

What is the length of one side of a vessel, which contains one million of solid feet? *Ans.* 100 feet.

Why? *Ans.* Because 100×100×100=1,000,000.

ALLIGATION.

What is Alligation? *Ans.* The mixture of fluids and medicine.

How many kinds does it consist of? *Ans.* 3.

What are they? *Ans.* Alligation Medial, Alternate and Partial.

When do you employ Alligation Medial? *Ans.* When the quantities and prices of several things are given to find the mean price of the mixture compound of those materials.

In the rule, what make the first term? *Ans* The whole composition.

What make the second? *Ans.* The whole value.

What make the third? *Ans.* Any part of the composition.

What will the fourth term be? *Ans.* The mean price.

Note.—The remaining rules in Alligation as they cannot be abridged, or simplified, may as well be learned from the Arithmetic of which this is an accompaniment.

Some useful rules for finding the contents of superficies and solids.

What is a straight line? *Ans.* The nearest distance between two points.

If two lines are at equal distances from one another in every part, what are they called? *Ans.* Parallel lines.

If two lines are not at equal distances from each other in every part, what is the consequence, if they are continued from those parts that incline to each other? *Ans.* They must meet.

What is the place of meeting called? *Ans.* An angle as A in figure 1st.

What may the corner of any thing be called? *Ans.* An angle.

When a line falls directly on another line so as to make the angles on both sides equal; what is the line called? *Ans.* A perpendicular.

What are the angles on each side called? *Ans.* Right angles.

How many degrees do a right angle consist of? *Ans.* 90 as C in figure 3d.

What are all angles except right angles, called? *Ans.* Oblique.

How many kinds of oblique angles are there? *Ans.* Two.

What are they? *Ans.* Acute and Obtuse.

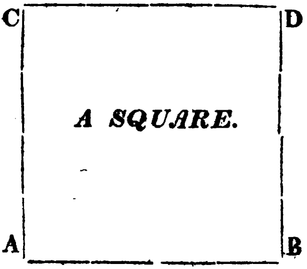
What is an acute angle? *Ans.* Less than a right.

What is an obtuse? *Ans.* Greater than a right.

Of how many degrees does an acute angle consist of then? *Ans.* Less than 90.

How many in an oblique? *Ans.* More than 90.

Figure 1.



What is a square? *Ans.* A figure whose sides are all equal and parallel.

How many degrees in each angle of a square? *Ans.* 90.

What are the angles called then?

How many angles in all the angles of a square then?

What is the area of anything? *Ans.* The surface or space enclosed by any lines.

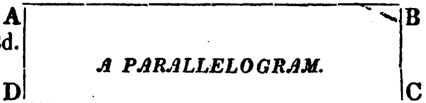
To find the area of a square, what is the rule? *Ans.* Multiply the side of the square into itself.

How many square feet of boards are contained in the floor of a room, which is 30 feet square? *Ans.* 900.

Suppose a square lot of land measures 40 rods on each side, how many acres does it contain? 40×40 =1600÷160=10 the answer.

Why divide by 160 in the above? *Ans.* Because the answer is square rods, and square rods must be divided by square rods, square feet by square feet, solid feet by solid feet, &c.

Fig. 2d.



What is a parallelogram? *Ans.* It is a long square, or it is a figure, that had its opposite sides equal, and parallel.

What is the rule for measuring a parallelogram? *Ans.* Multiply the length by the breadth.

A garden is 200 feet long, and ten feet wide; how many feet of ground are there in it? *Ans.* 2000 feet.

If a board be 10 inches wide and 15 feet long; how many feet in it? *Ans.* 1 foot.

If a board is 12 inches long and 12 wide, how many feet in it? *Ans.* 1 foot.

If a board is 12 inches wide, and 24 inches or 2 feet does it contain? *Ans.* 2 feet.

How many feet will a board that is 12 inches wide always contain? *Ans.* As many feet as the board is feet in length.

If a board is 6 inches or ½ foot wide and 1 foot long, how many feet will it contain? *Ans.* ½ a foot.

If 2 feet long? *Ans.* 1 foot.

As a board 12 inches wide, contains just as many feet, as the board is long; now tell me how many feet in a board that is 2 feet wide? *Ans.* Twice the number of feet that the board is long.

How many feet are contained in a board that is 2 feet wide and 24 feet long.

What is a triangle? *Ans.* Any three cornered figure bounded by three straight lines; as figure 3d.

Fig. 3.

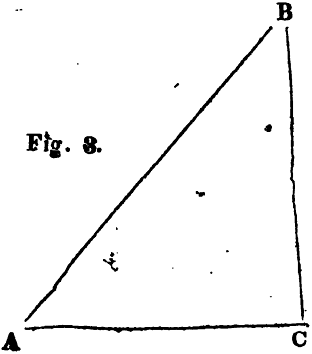
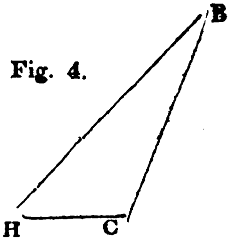


Fig. 4.



Does the greatness of an angle depend on the length of the two lines which form it, or the width of their opening? *Ans.* On the wideness of their opening.

Which is the greatest and smallest angle in fig. 4.

How many degrees are all the angles in any triangle? *Ans.* 180.

One angle, in a right angled triangle, is always 90; how many degrees are in the two other angles? *Ans.* 90.

In a right angled triangle, what is the longest side called, as A B in figure 3? *Ans.* Hypothenuse.

What are A C and B C called in figure 3? *Ans.* legs.

What is the rule for finding the area of a triangle? *Ans.* Multiply the base of the given triangle into half its perpendicular height.

Required the area of a triangle whose base, or longest side 30 inches, and the perpendicular height, 14 inches? *Ans.* 210 square inches.

To find the content of any regular solid of three dimensions, length, breadth and thickness, as a piece of timber squared, whose length is more than the breadth and depth; what is the rule? *Ans.* Multiply the breadth by the depth, or thickness, and that product by the length, which gives the solid content.

A square piece of timber, being 2 feet broad, 4 feet thick, and 9 feet long; how many solid does it contain?

To find how many solid feet a round stick of timber, equally thick from end to end will contain, when hewn square; what is the rule? *Ans.* Multiply twice the square of its semi-diameter in inches, by the length in feet, then divide the product by 144, and the quetient will be the answer.

If the diameter of a round stick of timber be 12 inches, and its length 20 feet, how many solid feet will it contain, when hewn square? *Ans.* $6\times6\times2\times20\div144=10$ feet the answer.

Te find how many feet of square edged boards, of a given thickness, can be sawn from a log of a given diameter; what is the rule? *Ans.* Find the solid content of the log by the last rule÷Then say, As the thickness of board including the saw calf; is to the solid feet: so is 12 (inches) to the number of inches required.

How many feet of square edged boards, 1¼ inches thick, including the saw calf, can be sawn from a log 20 feet long, and 24 inches diameter—12×12×2×20÷144=40 feet solid content. As 1¼ : 40 : : 12—384 feet the answer.

Repeat the denominations of Linear, or Long Measure, with their corresponding Square Measures:

Linear or Long Measure.				*Square Measure.*			
12	inches	1	foot,	144	inches	1	foot,
3	feet	1	yard,	9	feet	1	yard,
6	feet	1	fathom,	36	feet	1	fathom,
16½	feet	1	rod,	272¼	feet	1	rod,
5½	yards	1	rod,	30¼	yards	1	rod,
4	rods	1	chain,	16	rods	1	chain,
40	rods	1	furlong,	1600	rods	1	furlong,
320	rods	1	mile.	102400	rods	1	mile.

In the above tables how are the several denominations in Square Measure, produced? *Ans.* They are the squares of their corresponding denominations in Long Measure.

For example how is 144 produced? *Ans.* 12×12=144.

How is 272¼? *Ans.* 16½×16½=272¼.

DUODECIMALS.

By whom are Duodecimals, or Cross Multiplication used? *Ans.* By artificers.

For what purpose? *Ans.* In measuring their several works.

What else may it be applied to? *Ans.* To the measuring of wood for fuel, &c.

Repeat the table—

12"" fourths make 1 third,
12"' thirds 1 second,
12" seconds 1 inch or primes,
12' inch or primes 1 foot.

What do feet multiplied by feet, give? *Ans.* Feet.

What do feet multiplied by inches, give? *Ans.* Inches.

What do feet multiplied by seconds, give? *Ans.* Seconds.

What do inches multiplied by inches, give? *Ans.* Seconds.

What do seconds multiplied by seconds, give? *Ans.* Fourths.

RULE.

How place the multiplier? *Ans.* Under the multiplicand, so that feet may stand under feet, inches under inches, &c.

With which denomination of the multiplicand do you begin to multiply? *Ans.* The lowest.

What multiply it by? *Ans.* The highest denomination in the multiplier.

How place the result of each multiplication? *Ans.* Feet under feet, inches under inches, &c, of the factors, and in the several products.

How many carry in all cases? *Ans.* One for every 12.

How place the product of the multiplication by the next highest denomination in the multiplier, and so on to the last? *Ans.* One figure further towards the right for each multiplication.

How are the several products to be added? *Ans.* As they then stand.

Is this method of multiplying confined to carrying by 12? *Ans.* It is not.

EXAMPLES,

Multiply $2\frac{1}{2}$ feet by $2\frac{1}{2}$ feet?

	Feet. Inch.	Or thus.	Or thus.
	2 6	2½	2 5
	2 6	2½	2 5
	5 0	5	125
	1 3 0	1¼	50
Ans.	6 3 0	6¼ sq. feet.	6,25 sq. ft.

You have said that feet multiplied by feet gives feet; do you mean square feet or not?

Why are duodecimals so called? *Ans.* From duodecimus (Latin)—signifying 12, because in multiplying we carry by 12.

Is it confined to *twelves*? *Ans.* It may be greatly extended.

In multiplying pounds, shillings, pence, &c. what do pounds multiplied by pounds give? *Ans.* Pounds.

What do pounds multiplied by shillings give? *Ans.* Shillings.

What do shillings multiplied by shillings and so on give, *Ans.* Twentieths of a shilling, &c.

	£ *s.*	£.		
Multiply	2 5	2¼		2,25
by	2 5	2¼		2,25
	4 10	$5\frac{1}{16}$	1	1125
	11 3		20	450
			—	450
	5 1 3 *Ans.*		16)20	
			—	5,0625
			1 4	20
			12	
			—	1,2560
			16)48.	12
			—	
			Ans. £5 1*s.* 3*d.*	3,0000